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KAGY (J. F.). **Toxicity of some Nitro-Phenols as Stomach Poisons for several Species of Insects.**—*J. econ. Ent.* **29** no. 2 pp. 397–405, 13 refs. Menasha, Wis., April 1936.

The following is substantially the author's summary: Several organic compounds not previously tested as stomach insecticides have been administered by the leaf sandwich method to the last instar larvae of *Heliothis armigera*, Hb. (*obsoleta*, F.), *Cirphis unipuncta*, Haw., and *Pieris* (*Ascia*) *rapae*, L. Of these, 2–4 dinitro-6-cyclohexylphenol and its calcium, magnesium, lead and copper salts were found to be several times as toxic as acid lead arsenate to *H. armigera*. Calcium 2–4 dinitro-6-cyclohexylphenate, which was the most toxic salt examined, was about 4·4 times as toxic to *H. armigera*, 17 times to *C. unipuncta* and significantly more toxic to *P. rapae*. The speed of toxic action for the compound and its 4 salts was several times greater than for acid lead arsenate, the mean survival times ranging from 2 to 5 hours.

Arsenic trioxide, 2–4 dinitro-6-cyclohexylphenol and the calcium salt were fed quantitatively in baits to *Melanoplus femur-rubrum*, DeG. The calcium salt displayed rather low toxicity but the phenol was 2·5 times more toxic than arsenic trioxide. Furthermore, the speed of toxic action was approximately twice that of the arsenical.

The chemicals related structurally to 2–4 dinitro-6-cyclohexylphenol had little toxicity as stomach poisons. The indications were that deviations from the structure of the lethal phenol resulted in partial or complete loss of the high toxicity to insects. The consistent and promising results obtained with 2–4 dinitro-6-cyclohexylphenol and the four salts appear to recommend them for practical consideration as stomach insecticides.

MCPHAIL (M.) & BERRY (N. O.). **Observations of *Anastrepha pallens* (Coq.) reared from Wild Fruits in the Lower Rio Grande Valley of Texas during the Spring of 1932.**—*J. econ. Ent.* **29** no. 2 pp. 405–410, 2 figs., 1 ref. Menasha, Wis., April 1936.

Adults of *Anastrepha* (*Pseudodacus*) *pallens*, Coq., were observed on *Citrus* in the lower Rio Grande Valley of Texas in 1931. In an investigation in 1932, however, it was found to breed only in the fruits of *Bumelia spiniflora*, a shrub-like plant widely distributed over uncultivated land. This was also the only fruit on which females oviposited in the laboratory, though they were offered a variety of fruits, including *Citrus* and vegetables. Observations on oviposition, larvae development and pupation of this Trypetid are recorded, with notes on the ecological features of its habitat.

Migration of adults to *Citrus* is not connected with scarcity of other food-plants.

LATHROP (F. H.), CUPPLES (H. L.), HILEY (J.) & YUST (H. R.). **Comparative Toxicities of Methyl Thiocyanate and Hydrocyanic Acid to the California Red Scale.**—*J. econ. Ent.* **29** no. 2 pp. 410–412, 2 figs. Menasha, Wis., April 1936.

Data are presented to show that whereas about 10 times as high a concentration of methyl thiocyanate as of hydrocyanic acid is required to kill rats in a given time, these two compounds are about equally

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toxic to *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask. Comparative fumigations in California in which lemons infested with *A. aurantii* were exposed to various concentrations of each of these materials for 25 minutes at 25°C. [77°F.] showed remarkable similarity between their toxic effects, methyl thiocyanate being apparently the more efficient in killing the more resistant scale. In a further series of experiments under similar conditions methyl thiocyanate, hydrocyanic acid and mixtures of the two at the constant total concentration of ·071 mg.-mole per litre were about equally toxic to the scale. Methyl thiocyanate, however, is much more difficult to volatilise than hydrocyanic acid, and small-scale tests on young *Citrus* trees indicated that it is too injurious to the trees for use in fumigation, though the studies of the effects upon plant tissues are not definitely conclusive.

WILSON (C. C.). **Notes on the Warrior Grasshopper** *Camnula pellucida* **(Scudder) and its Egg Parasite** *Aphoebantus hirsutus* **Coquillet, in Northern California 1928–29.**—*J. econ. Ent.* **29** no. 2 pp. 413–416. Menasha, Wis., April 1936.

The biology of *Camnula pellucida*, Scudder, severe outbreaks of which, causing serious damage to cereal and forage crops, have occurred regularly since 1922 in the Tule lake district in northern California, was studied there in 1928–29 together with the activities of the Bombyliid *Aphoebantus hirsutus*, Coq., which parasitises its egg-capsules, in relation to type of soil and vegetation. The breeding grounds of *C. pellucida* were reduced in the Tule lake district (a former lake bed of about 45 sq. miles) from 5,000 acres of dense beds of eggs in 1927 to local and sparse beds in 1929 by the widespread use of poisoned bran acting together with natural enemies.

C. pellucida occurs in injurious numbers in mountain meadows, foothills and valleys throughout northern, central and coastal California in the transition and humid-transition life-zones, being of economic importance at elevations from sea-level to 5,000 ft. above. Unlike other Californian grasshoppers it has definite oviposition areas, travelling from these to green vegetation to feed between 10 a.m. and 3 p.m. Moist peat and sandy loam soils are apparently preferred for oviposition, but this preference is not very marked. The period of hatching, which covers about 2 months, varies according to climatic conditions, but usually extends from early May to the end of June, the young grasshoppers remaining in the area of the egg-bed. Oviposition areas should be marked off so that poison bran baits can be applied before the third instar nymphs migrate to field crops. Dissection of 104 egg-capsules from a random sample of 1,547 showed a total of 2,886 eggs, the number per capsule ranging from 16 to 36.

Observations of egg beds of varying size in 7 different localities to ascertain the degree of parasitism by *A. hirsutus* showed that the number of egg-capsules per sq. yd. (used as a unit for determining populations) was far from uniform. More heavily populated areas both of egg-capsules and Bombyliid larvae were usually found in moist peat and sandy loam soils, where weed and grass were present, than in arid areas of sand and rock where vegetation was sparse. Unconsumed eggs in every parasitised capsule examined failed to hatch. *A. hirsutus* attacked from 0·7 to 62·4 per cent. of the egg-capsules in 1928 and was an important control factor. In areas where heavy attack had been

observed in autumn the number of grasshoppers hatching was negligible, and it was only in the lightly attacked areas that they were present in sufficient numbers to warrant control measures.

McGovran (E. R.). **Laboratory Tests with impregnated Oil as Codling Moth Larvicides.**—*J. econ. Ent.* **29** no. 2 pp. 417–420, 4 refs. Menasha, Wis., April 1936.

About 100 materials were mixed with a refined petroleum oil and tested in the laboratory for toxicity to newly-hatched larvae of *Cydia* (*Carpocapsa*) *pomonella*, L. In general the investigation was directed to a comparison of compounds that contained copper, iodine, chlorine or bromine and compounds that contained the benzene or naphthalene structure. Nicotine sulphate was taken as a standard material of known toxicity. The impregnated oil was applied to rotating apples by an atomiser, spraying being done at 18–24°C. [64·4–75·2°F.]. After the apples had been stored at room temperature for 24 hours, 10 newly-hatched larvae of *C. pomonella* were transferred to each apple. The fruits were then kept at 26·7°C. [80·06°F.] and 50 per cent. relative humidity for 24 hours. During this period, all larvae not killed by the spray treatment entered the fruit, and the apples were stored in the greenhouse at 18–30°C. [64·4–86°F.] for 5 days, after which the number of " stings " and entries were recorded. Apples sprayed with the oil alone were used as a control, about 35 per cent. of the larvae that would have entered unsprayed apples being killed. The majority of the mixtures were little, if any, more toxic than oil alone. At a concentration of 2 per cent. in the oil, nicotine sulphate gave 100 per cent. control of entries and methyl salicilate 71 per cent. Mixtures containing copper were generally toxic, copper cyanide giving the best result (59 per cent. control). Copper oleate was fairly toxic at 2 per cent. in the oil, but only slightly toxic at 5 per cent. Other materials tested that were toxic at 2 per cent. in the oil showed little increase in toxicity at 10 or 20 per cent., and some were less toxic. Mixtures containing iodine, chlorine and bromine ranked in that order in toxicity to the larvae. The mixtures containing the naphthalene group were slightly more toxic than those containing the benzene group. Anthracene and 9–10 dichloroanthracene were practically non-toxic.

Snipes (B. T.), Hutchins (R. E.) & Adams (J. A.). **Effectiveness of Sodium Fluoride, Arsenic Trioxide and Thiodiphenylamine as Food Poisons for the Firebrat** *Thermobia domestica* **(Packard).**—*J. econ. Ent* **29** no. 2 pp. 421–426, 1 fig., 4 refs. Menasha, Wis., April 1936.

The following is the authors' summary: Firebrats (*Thermobia domestica*, Pack.) reared and kept at 34·5°C. [94·1°F.] and about 70 per cent. relative humidity were confined singly with access to their preferred food (100 gm. finely-ground rolled oats, 5 gm. powdered cane sugar and 2·5 gm. finely-ground table salt) mixed with various concentrations of 3 poisons. Care was taken that the insects were not compelled to remain in contact with the bait. In addition to the controls, none of which died, 100 individuals were tested with each concentration for periods of one week. With thiodiphenylamine, at concentrations up to 20 per cent., only a few insects died. With arsenic trioxide 4, 12 and 20 per cent., about two-thirds of the insects

died. With sodium fluoride, 4, 8 and 12 per cent., about nine-tenths of the insects died. Preliminary tests indicated that both contact effects and repellence by poisons are significant in the effectiveness of these mixtures. A bait is recommended in which 7 per cent. of the weight is sodium fluoride.

HOCKENYOS (G. L.). **Mechanism of Absorption of Pyrethrum Powder by Roaches.**—*J. econ. Ent.* **29** no. 2 pp. 433–437, 2 refs. Menasha, Wis., April 1936.

A series of tests in which mixtures of pyrethrum and talc were dusted heavily on cockroaches showed that there is a period of induction of about 1½ minutes before any reaction is produced. The length of this period does not vary for any concentration of pyrethrum strong enough to produce the reaction (10 per cent. or more). The first reaction is one of great excitement, and it is followed by a stage of partial paralysis and then helpless paralysis. The time elapsing before the incidence of the last two reactions is influenced inversely by the concentration of pyrethrum in the dust. There is evidence that a dust containing 25 per cent. pyrethrum powder is more effective than one containing 50 per cent. or one containing less than 25 per cent., but less effective than one containing 100 per cent.

Tests were also carried out in which powdered pyrethrum was applied to various parts of the bodies of cockroaches to determine the manner in which the poison is absorbed. In further tests the cockroaches were dipped in medium hard paraffin wax heated to the point of becoming completely fluid and then dipped in cold water to form a coating over different parts of the body, the uncoated portion receiving the dust and exclusively absorbing the poison. The results obtained suggested that the cockroaches are most affected by absorption of the toxic principles through the body integument and very little by either penetration of the spiracles or ingestion through the mouthparts.

BORDEN (A. D.). **Tank-Mixture Method of using Oil Sprays for deciduous Fruits.**—*J. econ. Ent.* **29** no. 2 pp. 438–439, 2 refs. Menasha, Wis., April 1936.

Experiments on the use of oil sprays prepared by the tank-mixture method for spraying deciduous fruit trees in northern California during the past 3 years have shown that they are more efficient and economical than proprietary emulsions in the control of many pests of these trees [*cf. R.A.E.*, A **23** 102]. Wide variations in the amount of oil deposited by different brands of proprietary emulsions are due to differences in the kind and amount of emulsifier. Variations in oil deposit on 25 square inches of waxed surface, sprayed for 15 seconds with a mixture of 5 per cent. actual oil, ranged from 22 to 55 mg. with dormant emulsions and with a 1 per cent. concentration of summer oils from 4 to 28 mg., the same dosage being recommended for those giving light or heavy deposits. Oils having undesirable qualities as to volatility and unsulphonated residues are also used in some proprietary emulsions, to the detriment of their efficiency. In the tank-mixture method the spreader and oil are added to the water in the spray tank and a uniform mixture maintained by effective agitation. The addition of 4 oz. powdered blood albumen spreader gives a higher oil deposit than any of the proprietary oil emulsions.

As the result of field investigations, a spray oil having a viscosity of 100–120 seconds Saybolt at 100°F. and an unsulphonated residue not lower than 70 per cent. is recommended for dormant sprays, and for summer tank-mix sprays oils having viscosities ranging from 50 to 70 seconds Saybolt and unsulphonated residues not lower than 90 per cent. Uniform mixtures may be obtained with the propellor type agitators by speeding the agitator shaft up to 200 r.p.m., or with the new flat-type agitators [*cf.* **22** 96] by running the shaft at 100 r.p.m. The energy consumption for agitation alone at the higher speeds is about ½ h.p., and at the lower speeds ¼ h.p., which is more practical with the low-powered outfits generally used in deciduous fruit districts. It has been possible to use the oil in the tank-mix spray at a much lower dosage than proprietary emulsions and yet obtain excellent results. The advantages of the tank-mix method over the use of commercial oil emulsions, which are summarised, include the formation of uniform film with high oil deposit and little run-off, making possible a reduction of the dosage by half, and the small cost of the materials, which is about 50 per cent. less than the cost of commercial emulsions.

McAlister, jr. (L. C.). **Observations on the West Indian Fruit Fly at Key West in 1932–33.**—*J. econ. Ent.* **29** no. 2 pp. 440–445. Menasha, Wis., April 1936.

A more detailed account is given of the investigation carried out in 1932 and 1933 to obtain further knowledge concerning the food-plants and reaction to bait-sprays of *Anastrepha acidusa*, Wlk., and *A. suspensa*, Lw., on the Island of Key West, Florida [*cf. R.A.E.*, A **24** 417, etc.]. Data are given concerning pairing, oviposition and longevity of the adults, together with a list of the 35 species of fruits on which *A. acidusa* has developed successfully, many of which are also attacked by *A. suspensa*.

In 40 experiments with tartar emetic, in which a total of 896 flies were used, and 7 experiments each in which lead arsenate and nicotine sulphate were used with a total of 300 flies, the relative lengths of time required to obtain 100 per cent. mortality averaged 65·3 hours for lead arsenate (8 lb., sugar 50 lb., molasses 10 U.S. gals., water 190 U.S. gals.) ; 50 hours for nicotine sulphate (1 gal. to 200 gals. water plus 10 per cent. molasses) ; and 27·6 hours for tartar emetic (8 lb. to 5 U.S. gals. molasses and 100 U.S. gals. water). Concentrations of tartar emetic ranging from 2 to 8 lb. per 100 U.S. gals. water were used, mortality being more rapid at the higher concentrations. The results of several tests indicated that tartar emetic may persist for 7–9 days if rainfall is slight and for 14 days if it is completely absent, but that as little as ·25 inch rainfall will greatly reduce the toxicity of sprayed foliage. No injury to fruit or foliage resulted from its use. Attention is called to the precautions to be taken by persons applying tartar emetic, which may set up local necrotic areas on the skin.

Dearborn (F. E.). **Homologs of Paris Green II. Higher Members of the Acetic Acid Series.**—*J. econ. Ent.* **29** no. 2 pp. 445–449, 3 refs. Menasha, Wis., April 1936.

An investigation was carried out to determine whether the higher fatty acids of the acetic series form definite complex compounds with copper and arsenic similar to the compounds formed by the lower members of the series [*cf. R.A.E.*, A **23** 649]. The methods of analysis

are described. A study of the findings indicates that lauric, palmitic, stearic and probably melissic acids form definite complex compounds with arsenic and copper. The ratio of arsenic to copper in the compounds is the same as those formed by the lower homologues [*loc. cit.*], namely, 3 molecules of copper meta-arsenite united with one molecule of copper salt of the fatty acid, from which the inference may be drawn that all the acids of the acetic series form compounds with the general formula $3CuAs_2O_4.Cu(acid)_2$. Owing to the meagre data collected and to the poor physical condition of the test samples, no conclusion as to toxicity can be drawn.

METZGER (F. W.). **Value of Improvements in Japanese Beetle Traps and Bait as measured by the Numbers of Beetles caught.**—*J. econ. Ent.* **29** no. 2 pp. 449–454, 1 fig., 7 refs. Menasha, Wis., April 1936.

The course of improvements made in bait traps designed to catch *Popillia japonica*, Newm., is traced chronologically through the years 1924–34 [*cf. R.A.E.*, A **17** 421]. As the traps can be tested only when the beetles are abundant, a period of at most 6 weeks per year, the changes have been gradual [*cf.* **22** 410, etc.]. Data indicate that in an equal infestation the trap as improved in 1934 is probably capable of capturing 55 times as many beetles as that devised in 1925. In lightly-infested areas traps capture a higher percentage of the beetles that are attracted than in regions where *P. japonica* is present in great numbers. Improvements in bait have not resulted in a trap that will attract all the beetles in the immediate vicinity, nor have the improvements in the trap resulted in one that will capture all the beetles attracted.

SORENSON (C. J.). *Lygus* **Bugs in Relation to Occurrence of shriveled Alfalfa Seed.**—*J. econ. Ent.* **29** no. 2 pp. 454–457. Menasha, Wis., April 1936.

An investigation was carried out in Utah in 1932, 1933 and 1934 to ascertain whether *Lygus hesperus*, Knight, and *Lygus elisus*, Van D., which occur in great numbers in practically all lucerne seed fields, bear any relation to the occurrence of shrivelled seed, and through it to the reduction of both quality and quantity of the yield. When the bugs were encaged on young lucerne pods, on racemes of young pods until ripe, and on stems bearing racemes of buds, flowers and young pods until ripe in 3 successive years, the feeding of *Lygus*, even for a short time, increased the number of shrivelled seeds, the increase being generally in proportion to the degree of infestation. The total number of seeds may possibly be reduced by the feeding of the bugs, and smaller yields of poorer quality lucerne seed may result, partially at least, from heavy infestations. The production of an appreciable amount of shrivelled seed on stems in check cages protected from attack by *Lygus* shows that these bugs are not the exclusive cause of the phenomenon, and that other environmental factors contribute to its causation.

BYNUM (E. K.) & BALZER (A. I.). **Cold-water Treatment as a Control for the Sugar Cane Borer.**—*J. econ. Ent.* **29** no. 2 pp. 458–459, 1 ref. Menasha, Wis., April 1936.

Investigations have long been conducted in Texas and Louisiana to prevent spring infestation by *Diatraea saccharalis*, F., due to

hibernation of the larvae in seed cane. They also hibernate in cane trash, cane stubble, planted cane stalks, maize stalks, sorghums and large uncultivated grasses. The results of experiments conducted independently by the authors in two localities over a period of 5 years definitely show that the immersion of seed cane for 72 hours in water at ordinary temperatures [*cf. R.A.E.*, A **16** 463] gives only a partial kill of the larvae and cannot be recommended for treating infested sugarcane destined for territory where *D. saccharalis* does not occur. As, however, the mortality is high enough to give partial control, the treatment might be advisable as a plantation practice under some conditions.

Daniel (D. M.). **Mass Liberation of an Oriental Fruit Moth Parasite.**—*J. econ. Ent.* **29** no. 2 pp. 459–461, 1 fig. Menasha, Wis., April 1936.

The effect of inundating an isolated area of infestation with large numbers of *Macrocentrus ancylivorus*, Rohw., in order to reduce injury by the oriental fruit moth [*Cydia molesta*, L.] more immediately than by the gradual method usually followed was tested at the New York Agricultural Experiment Station in 1933. Infestation of an isolated peach planting by *C. molesta* had reached 50 per cent. in 1932 in a solid block of 72 acres containing about 9,000 trees 10–20 years old. Following the release of 200 females of *M. ancylivorus* on 14th July 1932, infestation by *C. molesta* was found to be 48·3 per cent. at harvest, an estimated total of 5,635,000 peaches being produced. Thus larvae of *C. molesta* were present in 2,720,000 peaches. Collections of twig-infesting larvae in June 1933 showed parasites to be well distributed throughout the orchard, though the percentage of parasitism was less than 5. Between 30th June and 31st August about 12,000 further parasites were liberated. The estimated production of peaches at harvest was 4,680,000 of which 15·96 per cent. were infested, or a reduction of 72 per cent. over the number of larvae of *C. molesta* present in 1932. In 3 neighbouring orchards that had received liberations in 1932 no such reduction occurred, infestation being practically the same in 1933 as in 1932. As practically all the trees in the entire block were killed by frost in the winter of 1933–34, it was impossible to continue the experiment over a longer period. It cannot be repeated, as infestation by *C. molesta* has fallen too low for mass liberations to be of benefit.

Tietz (H. M.). **A novel Light Trap.**—*J. econ. Ent.* **29** no. 2 p. 462, 1 fig. Menasha, Wis., April 1936.

A light trap consisting of a glass globe pierced by 3 deeply indented slots through which insects enter so that they are killed by heat generated by the electric light fixed in the centre of it, has been designed for attachment to porch lights or elsewhere. It serves the double purpose of trap and light, does not require the use of poisons, will collect as many as 1,000 specimens on favourable nights, and is clean. Records of the effect of weather conditions on the operation of this trap during the month of August showed temperature and moisture to be the most important factors determining the catch. Below 70°F. the catch was small, and the optimum temperature was about 85°F. Heavy showers stopped all flight, and the best catches were made when there was no wind. A cloudy sky appeared favourable and moonlight nights were unfavourable unless other conditions were very good. Any insect small enough to pass through the slots was captured and killed.

Jassids were the most numerous among insects taken, parasitic Hymenoptera being next in abundance. Many of the Lepidoptera caught were the adults of cutworms.

McGovran (E. R.) & Farrar (M. D.). **Fog Chamber : A Technique for determining Spray Injury to growing Plants under Laboratory Conditions.**—*J. econ. Ent.* **29** no. 2 p. 463. Menasha, Wis., April 1936.

Injury under field conditions to foliage and fruit of plants sprayed with certain insecticides normally appears after periods of rain or high humidity for 6–48 hours. The moisture accumulating on the fruit and foliage drops off very slowly, so that chemical activity proceeds rapidly and for relatively long periods on the sprayed surface, and the plant itself becomes filled with water. When practically no evaporation takes place from the stomata the plant may force liquid water out through the leaves, and this aqueous connection may allow any soluble material present on the surface to diffuse itself into the plant. In order to gain information on foliage injury, a technique has been devised whereby these reactions are adapted to laboratory conditions. A section of a greenhouse bench was used to construct a fog chamber 5 ft. square, the bench itself, the greenhouse side and top forming 3 sides and the others being of cello-glass (screen wire covered with cellulose). To determine injury, sprayed plants are placed for 24–48 hours in the fog chamber through a door provided in one side of it. A constant fog is maintained by means of 3 atomiser jets operated by a constant water supply and compressed air. Water is supplied to the jets through independent rubber tubes leading from a vessel kept full by connection with the laboratory faucet and compressed air from a laboratory air line keeps the atomiser jets operating constantly.

McDaniel (E. I.). **Control of the Potato Leafhopper** *Empoasca fabae* **on Dahlia with Flour, Talc and infusorial Earth.**—*J. econ. Ent.* **29** no. 2 p. 464. Menasha, Wis., April 1936.

A series of experiments was carried out in Michigan in 1935 to discover the most effective method of controlling *Empoasca fabae*, Harr., which is destructive to dahlias in late July or early August. When it has attained large numbers on a variety of food-plants, winged adults of *E. fabae* migrate to gardens, where they feed on the foliage of dahlias and insert their eggs in the main veins of the leaves, causing tip burning and dwarfing growth. Some varieties are more susceptible to attack than others, and these were selected for experiment, 15 plants, scattered through the field, being used for each of 2 sprays and 5 dusts. Neither of the sprays had any lasting effect although they killed individuals actually hit. The dusts, although they gave a poor kill, acted as repellents, and dusted plants put on vigorous new growth. Of the dusts used, 4 per cent. nicotine gave the best results and acted longest as a repellent. As the repellent effect long outlasted the activity of the killing agents, it was decided to dust plants only with inert carriers such as infusorial earth, talc and flour, each plant being dusted twice. Infestation was checked by the first application, and no difference could be detected between the materials used, the plants being as adequately protected as with nicotine dust or high grade pyrethrum. Dusts showing repellancy were all white ; the coloured dusts tested did not repel.

Butcher (F. G.). **Injury to Carrots by the Potato Scab Gnat, *Pnyxia scabiei* (Hopkins).**—*J. econ. Ent.* **29** no. 2 pp. 464–465. Menasha, Wis., April 1936.

Pnyxia scabiei, Hopk., is recorded as causing injury to carrots in North Dakota. In October 1935, carrots infested with Mycetophilid larvae were placed in storage at a temperature of 6–8°C. [42·8–46·4°F.] and left undisturbed until January 1936. After they were brought out into room temperature on 13th January an adult female of *P. scabiei* emerged. The facts that a bacterial rot typical of that caused by *Bacillus caratovorus* was present and that numerous typical bacteria, which are known to enter only through wounds, were found in the affected tissues, suggest that injuries from the larvae of *P. scabiei* may be important avenues of infection by this pathogene.

Hixon (E.) & Sooter (C. A.). **Freezing Temperatures of the Chinch Bug, *Blissus leucopterus* Say.**—*J. econ. Ent.* **29** no. 2 pp. 465–466. Menasha, Wis., April 1936.

Observations of 187 individuals of *Blissus leucopterus*, Say, removed from hibernation in Oklahama in February and March 1935 and frozen in a chamber cooled by the evaporation of carbon dioxide by a technique which is described, showed that the chinch bugs are more resistant to cold in February than in March. This indicates that *B. leucopterus* goes into true hibernation which is broken in early spring, at which time resistance to cold is lowered. *B. leucopterus* had a mean freezing point of 9°F. for February and 17·5°F. for March compared with 10°F. and 15°F. on corresponding dates for *Anthonomus grandis*, Boh., which emerges from hibernation in Oklahama in June, the chinch bug emerging in April. The number of degrees of rebound was greater for chinch bugs in February than in March (4·02 as compared with 3·90°F.) although their undercooling and freezing points were significantly lower at the same time (5·2 and 9°F. as compared with 14·4 and 17·5°F.). This indicates that there is not a direct correlation between winter hardiness of *B. leucopterus* and the amount of bound water present in its tissues.

Fulton (B. B.). **Lead Arsenate and Wetting Agents for Corn Earworm Control.**—*J. econ. Ent.* **29** no. 2 p. 466. Menasha, Wis., April 1936.

Wetting agents hitherto used to carry lead arsenate deeply into maize silks for the control of larvae of *Heliothis armigera*, Hb. (*obsoleta*, F.) have been unsatisfactory, as they fail to penetrate, injure the ear or impart an undesirable flavour. New wetting agents applied during the summer of 1935 at ·25 per cent. combined with lead arsenate at ·5 per cent caused severe injury to many ears, but in a second series of experiments made in August, when infestation was at its maximum, the concentration of both ingredients was reduced by half and little injury resulted, control of *H. armigera* being better than any previously obtained under similar conditions. With 4 applications at 4–day intervals, the percentages of infestation were as follows : SS–3 34 per cent., sodium oleyl sulphate 17 per cent., lethane spreader 59 per cent., tergitol-7 54 per cent., sodium lauryl sulphate 58 per cent., lead arsenate alone (dust) 82 per cent., control 99 per cent. The percentage infestation includes all ears with living larvae on the cobs or in the silk.

The liquids were applied with a specially prepared nozzle delivering a fine straight jet directed onto the silks from above for 1 second.

LILLY (J. H.). **Selenium in Dormant Sprays.**—*J. econ. Ent.* **29** no. 2 pp. 466–467. Menasha, Wis., April 1936.

A potassium-ammonium-seleno-sulphide compound (Selocide concentrate) [*cf. R.A.E.*, A **21** 565], which has hitherto been used at 1–600 with either summer oil or summer strength lime-sulphur against red spider [*Tetranychus*], and which is not sold as a general contact insecticide, was tested in north-eastern Wisconsin in 1935 for the first time in combination with both dormant strength lime-sulphur and tank-mixed emulsions of light lubricating oil. The Selocide concentrate was used with both oil and lime-sulphur at rates of 1–400 and 1–200 in the final dilutions. The combinations with oil were in a series consisting of a single oil (Diamond paraffin), the toxicity of which was increased with various oil-compatible contact insecticides. These combinations were tested at low concentration (4 per cent. instead of the usual 6 per cent.) to show the merits of the respective supplementary materials. Calcium caseinate was used at 1–100 as the emulsifying agent. The following percentages of kill were obtained against *Coleophora pruniella*, Clem., *Eucosma* (*Spilonota*) *ocellana*, Schiff, and *Tortrix* (*Archips*) *argyrospila*, Wlk., respectively, on apple : with Diamond paraffin used alone 71·6, 48·5, 81·4 ; with Diamond paraffin and $6\frac{1}{4}$ per cent. Selocide concentrate 90, 77·3, 93·8 ; with Diamond paraffin and $12\frac{1}{2}$ per cent. Selocide concentrate 97·8, 78·8, 85.

In the parallel tests with lime-sulphur, 1 gal. liquid lime-sulphur was used to 11 gals. water, but the actual quantity was the same in all plots, so that all supplementary materials used increased the total volume of the concentrated insecticide in the final preparations. Lime-sulphur 1–12 with Selocide concentrate at 1–400 and 1–200 gave kills of *C. pruniella* of 99·5 per cent. and 99·9 per cent. respectively. The same concentration of lime-sulphur with 40 per cent. nicotine sulphate at 1–600 gave 99 per cent. control, and 1–12 lime-sulphur without supplement gave 88·3 per cent. kill. The combinations of Selocide concentrate were apparently not effective against *T. argyrospila* and only partially effective against *E. ocellana*.

GUY (H. G.). **Thiuram Sulfides as Repellents to Leaf-feeding Insects.**—*J. econ. Ent.* **29** no. 2 p. 467. Menasha, Wis., April 1936.

In investigations in Delaware since 1933 with thiuram sulphides, the following insects have been prevented from feeding upon their food-plants by dusts and sprays containing these compounds : Colorado potato beetle [*Leptinotarsa decemlineata*, Say] (potato), Mexican bean beetle [*Epilachna varivestis*, Muls.] (bean), eastern tent caterpillar [*Malacosoma americana*, F.] (wild cherry), and Japanese beetle [*Popillia japonica*, Newm.] (smartweed). The most effective compound in this group so far discovered is tetra methyl thiuram bisulphide.

FLANDERS (S. E.). **Remarkable Phenomenon of Reproduction in the Parasitic Hymenoptera.**—*J. econ. Ent.* **29** no. 2 p. 468. Menasha, Wis., April 1936.

The author records in greater detail [*cf. R.A.E.*, A **24** 494] a differential development of the sexes observed in several species of the

genus *Coccophagus*. Females are produced only by fertilised females and develop only as primary parasites of Lecaniine scales and mealybugs. Males of the species of this genus investigated were produced only hyperparasitically on their own species or on other parasitic Hymenoptera.

In certain species such as *C. scutellaris*, Dalm., *C. modestus*, Silv., and *C. lycimnia*, Wlk., the stimulus of fertilisation is followed by a marked change in the host preferences of the females. *C. scutellaris* and *C. modestus*, when paired, normally oviposit in the body cavity of *Lecanium*. Before pairing, they normally deposit their eggs in the body fluids of an immature primary parasite. Both sexes are endoparasitic. *C. lycimnia*, when fertilised, also oviposits in the body cavity of *Lecanium*, but when unfertilised, oviposits only in parasitised scales the contents of which have been consumed by a primary parasite. The eggs are deposited on the surface of the primary parasite, which is then in the last larval instar, only females being endoparasitic in this case. The males develop ectoparasitically, and the early larval instars differ from those of the female in the structure of the respiratory system and in other morphological characters.

In other species, as in *C. gurneyi*, Comp., fertilisation is not followed by any change in the oviposition behaviour of the females, eggs of both sexes being deposited in the body cavity of the Homopterous host. If the male egg is deposited first, the embryo completes its development, but hatching is inhibited as long as it is exposed to the body fluids of the host. This male egg does hatch, however, if subsequently the contents of the host are consumed by another parasitic larva and the body fluid of the Coccid has been replaced by air. When a larva so produced emerges from the egg, it locates the primary parasite, penetrates its body wall and develops endoparasitically until nearly full-grown, then bores its way out and completes its development as an ectoparasite.

In pure cultures of most species uneven broods are essential for continuous reproduction. Field liberations should consist of mated and unmated females in order to facilitate the establishment of the species.

SCHAFFNER, jr. (J. V.). **European Sawfly *Pristiphora geniculata* attacks Mountain Ash in the United States.**—*J. econ. Ent.* **29** no. 2 p. 469. Menasha, Wis., April 1936.

Sawfly larvae, subsequently identified as *Pristiphora geniculata*, Htg., were taken on mountain ash in two localities in Massachusetts in 1928 and have since been recorded from widely scattered localities in New York and New England, causing defoliation. Where mountain ash is valued as a shade tree, control measures have been necessary. Local control was applied in one case in 1935 along many miles of road by pruning and burning twigs covered with the larvae, and the use of a lead arsenate spray is recommended. Laboratory records indicate that the majority of the adults of *P. geniculata* emerge during the latter half of May and early in June, but in 1930 and again in 1932 a few adults emerged in August of the same year in which the larvae were collected, indicating the possibility of a partial second generation.

ULLYETT (G. C.). **Host Selection by *Microplectron fuscipennis*, Zett. (Chalcididae, Hymenoptera).**—*Proc. roy. Soc. Lond.* (B) **120** no. 817 pp. 253–291, 6 figs., 21 refs. London, May 1936.

An account is given of work on *Microplectron fuscipenne*, Zett., carried out in view of its promise as a parasite of *Diprion polytomus*, Htg., and of its introduction into Canada [*cf. R.A.E.*, A **23** 747]. The general situation regarding host selection among entomophagous parasites is briefly reviewed from the literature, and the facts known from field records and laboratory observations concerning the biology of this Eulophid are reviewed. The various factors influencing the selection of the host by the parasite have been examined experimentally by means of a new technique, which is described. Previous experiments in measuring the relative attractiveness of true and false hosts for various parasites are criticised as taking insufficient account of the difference between field and laboratory conditions. By the new technique *M. fuscipenne* was found able to discriminate with ease between true and false hosts, such as appropriately shaped gelatine capsules, pieces of twig, pith, etc., even when they resembled the normal host in everything except the presence of the living larva within the cocoon. In the field the initial discovery of a host depends mainly upon a chance encounter, but laboratory observations have shown that the host itself exerts an influence that attracts the female parasite to it from a distance of 5–6 mm. The first stimulus is created by odour and is subsequently confirmed on antennal inspection by character of shape and possibly of texture. Evidence seems to suggest that final acceptance of the host depends to a large extent upon the presence of larval movement within the cocoon.

The selection within the host species as represented by a choice between parasitised and healthy individuals and also between the latter and unsuitable hosts was investigated. A high degree of discrimination existed between healthy individuals and hosts containing parasite larvae in their later stages. Those hosts containing eggs or newly hatched larvae, however, were accepted as readily as healthy individuals, perhaps because, though paralysed, they were still living and making recognisable movements. There is thus a definite proportion of every host population that is not subject to random oviposition. A discussion of the behaviour of the parasite shows that the underlying basis of host selection is psychological rather than mechanical.

Suggestions made for improving present methods of investigating insect behaviour include isolation of false hosts from the influence of true ones and the use of false hosts for the study of single characters of the true host. Elimination of abnormal conditions at the commencement of an experiment and the making of allowances for such abnormalities as cannot be eliminated in the calculation of final results are also discussed.

PETHERBRIDGE (F. R.) & MELLOR (J. E. M.). **Observations on the Life History and Control of the Cabbage Aphis, *Brevicoryne brassicae* L.**—*Ann. appl. Biol.* **23** no. 2 pp. 329–341, 1 pl., 6 refs. Cambridge, May 1936.

Following serious losses caused by *Brevicoryne brassicae*, L., in market gardens in Bedfordshire, Cambridgeshire and Huntingdonshire in 1933, a study of this Aphid was made there from November 1933 to

October 1935. A list of food-plants of *B. brassicae* is given [*cf. R.A.E.*, A **10** 262]. The symptoms of attack, which causes injury to the tissues by withdrawal of sap, including reduction in size, yellowing, curling and killing of the leaves and general stunting of the plants, are described, and the life-history is quoted. Observations during 1933–35 showed variations in the Aphids' behaviour. In 1934 they hibernated on cultivated cruciferous crops, particularly Brussels sprouts, only in the egg stage, whereas in 1935 they apparently overwintered as viviparous females also. In 1934, the first eggs did not hatch till 10th April as compared with 28th February in 1935. The first winged forms were found on 24th and 25th May respectively, but did not appear on the new crops until after mid-August in 1934, though they were found on spring cabbage on 15th July in 1935. By the end of the third week in August in 1935 they had become very numerous on Brussels sprouts, and the attack still further increased during September. Rains during September and early October appeared to assist in reducing the Aphids in 1934, but not in 1935, although they were much heavier.

Syrphids, particularly *Syrphus luniger*, Mg., were common in all districts, and by early October in both years had killed all the Aphids on some leaves and a large proportion on others. The Coccinellids, *Adalia bipunctata*, L., and *Coccinella septempunctata*, L., and their larvae were also common, but not sufficiently so to reduce the Aphids much. Hymenopterous parasites were active from April till October, neither spraying with 0·05 per cent. nicotine nor dusting with 3 per cent. nicotine dust checking their emergence, but they could not prevent the Aphids from multiplying rapidly when weather conditions were favourable. The following species were bred: *Diaeretus rapae*, Curt., *Asaphes vulgaris*, Wlk., and *Lygocerus testaceimanus*, Kieff., the first two being by far the most numerous, and the hyperparasite, *Charips victrix*, Westw., var. *infuscata*, Kieff.

Control measures should be directed at preventing the Aphids from passing from the old plants to the newly planted ones. A 3 per cent. nicotine dust or a spray consisting of 3 oz. 96–98 per cent. nicotine, 4 lb. soft soap or any suitable wetter and 40 gals. water should therefore be applied to seedlings during the second or third week in May. Before 15th May, all old Brussels sprouts, broccoli, cabbage and other *Brassica* plants should be ploughed under, and stalks and stumps collected and burnt. Autumn sown plants should be examined for Aphids at the time of planting, and if infested, dipped in 3 oz. nicotine with a wetter to 40 gals. water. *B. brassicae* is difficult to control on ordinary field crops, especially in August and September when the plants are large. Infested crops should be dusted with 3 per cent. nicotine dust in early and again in late July, using 40 lb. to the acre or more according to the size of the plants. Isolated infested plants found in Brussels sprouts fields should be carefully placed in bags, removed and destroyed.

JOHNSON (C. G.). **The Biology of *Leptobyrsa rhododendri* Horvath (Hemiptera, Tingitidae), the Rhododendron Lacebug. I. Introduction, Bionomics and Life History.**—*Ann. appl. Biol.* **23** no. 2 pp. 342–368, 3 pls., 4 figs., 63 refs. Cambridge, May 1936.

Of the 3 Tingids infesting rhododendrons and azaleas in Europe and the United States of America, only one, *Stephanitis* (*Leptobyrsa*)

rhododendri, Horv., is known to occur in Great Britain, where it is not considered to be indigenous. The literature dealing with it as a pest is briefly reviewed, and its distribution in Great Britain is given. The immature stages are described. During the last days of June, when the first adults usually appear, all stages may be present on a single leaf. Neither adults nor immature stages are active, but the latter are inclined to congregate. Adults migrate by walking from the leaves on which they hatch and by the end of July may be found on all leaves except extremely young ones. During August the majority gravitate to leaves of the current year, where most of the oviposition takes place. Bushes growing in the shade appear less liable to infestation, and it has been stated that rhododendrons growing in woods may be quite free from attack, although close to infested plants, and that spread is more rapid in a warm, dry summer. Flight is short, and though the insects may be blown by wind to other plants there is no evidence that the wings are used for migration. *S. rhododendri* has probably been distributed mainly by the moving of infested plants.

Pairing begins in mid-July, and was observed at latest on 30th September. It is not known whether individuals pair more than once during summer and autumn. The eggs are laid from late July in rows or clusters, on the underside of the leaf and mainly in the tissue at the side of the midrib. The author did not observe oviposition after 1st October in 1933, though it has been recorded considerably later. In Southampton there is only one brood a year, the immature stages found late in July being due to late hatchings of overwintered eggs. Double broods may, however, be expected in England and Europe generally, as sometimes in New Jersey, U.S.A., if hatching occurs very early in May and the summer is hot and dry. There is no evidence that the adults survive the winter.

PARKIN (E. A.). **A Study of the Food Relations of the *Lyctus* Powder-post Beetles.**—*Ann. appl. Biol.* **23** no. 2 pp. 369–400, 1 pl., 4 figs., 35 refs. Cambridge, May 1936.

Comparative analyses of wood and frass have proved that *Lyctus* larvae are unable to alter any of the true skeletal constituents of wood, though they cause reduction in starch content [*cf. R.A.E.*, A **19** 73]. Recent work confirming earlier findings [**22** 542, **24** 372] has shown that in Australian hardwoods generally infested with *Lyctus*, active attack was present only in those boards the sapwood of which contained more than a trace of starch. A similar result was obtained when numerous specimens of timber infested with *Lyctus*, obtained from insectaries at Princes Risborough, were examined for starch content.

An investigation was undertaken to ascertain what substances in wood are utilised by *Lyctus* larvae, in order to consider ultimately the possibility of treating wood in some way to remove these substances or to render them no longer available. The life-history of *Lyctus* spp. is briefly outlined [*cf.* **22** 544].

The following is mainly taken from the author's discussion and summary: The histology of the larval gut of *Lyctus* is described; owing to the absence of salivary glands and caeca, the digestive juices must be secreted by the midgut with doubtful contribution from the hindgut. The mycetomes contain organisms that are apparently not symbiotic in relation to digestion. The skeletal

substance of wood passes through the larval gut unaltered, nourishment being derived from the cell contents. As wood extracted with ether or alcohol is suitable for larval development, it appears that *Lyctus* does not depend upon fats and oils in the wood for food. A substance, soluble in water at 60°C., is necessary in oak sapwood for normal development. Artificial feeding experiments suggest that soluble sugars are likely to be the most important constituents. As larval development was retarded or inhibited in water-extracted samples containing a plentiful supply of starch, which must be hydrolysed to soluble sugars before the gut can absorb it, it is suggested that some other essential factor, perhaps a vitamin, may also be removed by the water. Larvae are unable to develop in wood from which starch is absent, and in wood containing little starch may take two years instead of one to complete their development. Enzymes capable of hydrolysing starch, maltose, sucrose, lactose and protein were detected in tissue suspensions of the gut and its contents. By feeding larvae on artificial diets it has been shown that starch, sugars and protein are necessary constituents of the larval food, and that larvae can be reared to the adult stage on a substrate containing no wood.

The ability of female beetles to determine the suitability of wood for larval development was demonstrated in tests in which pairs of adults were placed on variously treated samples of oak sapwood. When restricted in their choice, the females laid equally well in samples leached with water at 60°C. as in untreated controls containing abundant starch, but were disinclined to lay in boiled and naturally starch-free samples. Boiling the wood removes some substance that must be present if normal oviposition is to take place. Correlation was observed between the number of tasting marks made by the females on the wood without ovipositing in it, the number of eggs laid therein and the food value of the wood. It is concluded that the marks are not made by beetles seeking nourishment, and other explanations of them are discussed. Suitable wood has numerous incisions, and a sample having abundant starch at one end and little at the other has both eggs and marks concentrated at the starchy end. The female is, however, clearly able to detect the suitability of the wood without making these marks, and is therefore assumed to carry out a two-fold chemotactic test to distinguish suitable from unsuitable wood. If the primary test, in which the olfactory sense is employed, proves the wood to be starch-free, no further test is normally made, but if the wood is starchy the marks are made to confirm the presence of starch, or to test for that of other food materials necessary for the development of the larvae.

Data concerning the occurrence of starch in timber are discussed from the literature, together with the difficulties encountered in estimating it and removing it from the wood.

DAVIES (W. M.). **Studies on the Aphides infesting the Potato Crop. V. Laboratory Experiments on the Effect of Wind Velocity on the Flight of *Myzus persicae* Sulz.**—*Ann. appl. Biol.* **23** no. 2 pp. 401–408, 1 pl., 1 fig., 14 refs. Cambridge, May 1936.

In continued studies in Wales [*cf. R.A.E.* A **24** 61 etc.], laboratory experiments were carried out on the effect of variation in artificially produced wind velocity upon the flight of *Myzus persicae*, Sulz. In these experiments, wind was produced in the test chamber by means

of a small electric motor, and velocity was recorded by producing a cloud of smoke and measuring with a stop watch the time taken by it to pass through a glass tube equal in diameter to the mouth of the motor to which it was attached, and roughly checked by means of a flame anemometer placed at the exit of the experimental chamber. Conditions favourable to incessant flight were produced with less than 45 per cent. relative humidity, temperature above 70°F., and the light of a 500-watt lamp. When no wind passed through the experimental chamber, 25 winged Aphids averaged 154·8 flights per minute. The incidence of flight in a range of wind velocities, which is recorded, shows that low wind velocities had a marked influence in reducing flight, which ceased when the speed of the wind was increased to 3·75 m.p.h.

The Aphids remained stationary on the glass surface of the chamber when high winds of 20 and 30 m.p.h. passed through it, and even when the full force of the wind, equivalent to a gale of 70 m.p.h., passed over them. Microscopical observations showed that they possessed a small membranous pad between each claw and another at the base of each tarsus ; these are pressed to the surface and facilitate adherence.

The literature in regard to the dissemination of Aphids by wind is reviewed, and the phenomenon of voluntary migration as compared with involuntary transportation is discussed. It appears from the experiments that light air currents and drifts play a more important part in normal migration than do the prevailing winds. Convection and other upward air currents, and the physical effects of streams, lakes and mountains upon these air drifts must be considered in relation to Aphid migration from crop to crop.

Fidler (J. H.). **Some Notes on the Biology and Economics of some British Chafers.**—*Ann. appl. Biol.* **23** no. 2 pp. 409–427, 2 figs, 12 refs. Cambridge, May 1936.

In the British Isles, *Amphimallus solstitialis*, L., and *Serica brunnea*, L., are almost as injurious as *Melolontha melolontha*, L. A study extending over two years has, therefore, been made of the life-history, habits and economics of these cockchafers, with a view to comparison with the accounts of *M. melolontha* given on the Continent and in England, and this paper gives the results, together with some notes on *M. hippocastani*, F., and *A. ochraceus*, Knoch. There are few crops that are not attacked by cockchafer larvae, the damage being almost entirely restricted to the parts of the plant below the soil surface, though stems are sometimes girdled by *A. solstitialis* and *S. brunnea*. The side roots are usually removed, and where vegetation is sparse, *M. melolontha* will destroy all the roots. Records of crops attacked in Britain during 1914–34 are given ; 80 refer to *M. melolontha*, 23 to *A. solstitialis* and 19 to *S. brunnea*. Reports of *S. brunnea* are confined to the last 5–6 years, those of *A. solstitialis* go back about 15–20 years, and *M. melolontha* was recorded as a pest between 50 and 100 years ago. The absence of records of the other two species is probably due to their larvae being confused with those of *M. melolontha*. Damage caused by the adult beetles in Britain is not important.

The distribution, which is local, is controlled by the sparseness of suitable habitats and by the prevailing conditions of temperature and humidity. The beetles tend to oviposit in the field in which they have

developed, and neighbouring fields, even if forming perfectly suitable habitats, may not be infested. Soil temperature and humidity, rather than air temperatures and rainfall, are the deciding factors in distribution. As the larvae hibernate fairly deep in the soil, winter temperatures have probably little effect on them. In maps of the British Isles showing the mean July isotherms, *M. melolontha* is seen to occur as a pest where the mean July temperature is above 15·5°C. [59·9°F.] but has also been reported where the figure is as low as 14·5°C. [58·1°F.], whereas *M. hippocastani* occupies localities in which the summer temperature is less than 15·5°C., but not greater than 14°C. [57·2°F.], *A. solstitialis* is a pest where the temperature is above 16·5°C. [60·8°F.] or occasionally where it is below this but above 15·5°C., and *A. ochraceus*, which is much rarer, does not seem to occur in areas with a temperature below 15°C. [59°F.] or above 16·5°C. The distribution of all 4 species on the Continent is discussed. Altitude has an effect on distribution, probably connected with the fall in temperature with increase in height.

The factors controlling the varying lengths of the life-cycle are also shown to be mainly temperature and humidity. Thus though *S. brunnea* always takes 2 years to develop, *A. solstitialis* may take 2 or 3 years and *M. melolontha* 3 or 4, according to conditions controlled by these two factors. A higher soil humidity is necessary for the development of the eggs, which are usually laid at a depth of 4–5 inches in rather damp light soil, than for the older larvae, which obtain some moisture from their food. The incubation period of the eggs of *M. melolontha* lasts up to 28 days under artificial conditions and may vary by a week in different eggs of a batch laid simultaneously. The egg-stage of *A. solstitialis* lasts 18–28 days, and that of *S. brunnea* 15–22. The development of *M. melolontha* requires 3, 4 or 5 years, according to district on the Continent, but has been completed in as short a period as 18 months. An estimate of the life-history made by comparing large numbers of specimens taken in the field with the stages bred in the laboratory and studied under known conditions shows that the larval stage of *S. brunnea* lasts about 21 months, that of *M. melolontha* 32 or 37 and that of *A. solstitialis* 21 or 31. Rare variations beyond these limits are apparently due to the fact that hibernation occurs between October and March and a semi-dormant stage, which lasts 2 months, is required before pupation and cannot take place during the hibernation period. The length of the pupal stage, which occurs at a depth of 6–8 inches for *S. brunnea* and *A. solstitialis* and about 12–14 inches for *M. melolontha*, does not vary quite so much as the other stages in the life-cycle. *M. melolontha* may pupate in either spring or autumn of the fourth year, pupae formed in March producing adults in May. If pupation is delayed until the following August, adults formed after 6–8 weeks remain in their cells until the following spring. With *A. solstitialis* the larvae either pupate before the beginning of July or hibernate and pupate in the following spring. In the latter case, the pupal stage lasts 5–6 weeks and the adults remain in the soil until the usual time for emergence in July. With *S. brunnea* pupation starts early in June, and the pupal stage lasts about 4 weeks.

The adults dig their way towards the surface and emerge when the temperature becomes suitable (about 20°C. [68°F.] for *M. melolontha* and higher for the other two species). In the south of England *M. melolontha* usually appears at the end of the first week in May, *A. solstitialis* at the beginning of July and *S. brunnea* a few days later.

A. solstitialis flies from 8.30 p.m. to 10 p.m., the other two species, which are more noticeably attracted to lights, somewhat later. *Hoplia* and *A. ochraceus* fly in bright sunlight. During the day and latter part of the night, the beetles shelter in the soil or undergrowth, or, as is the case with *Melolontha*, cling to high branches. Mating occurs in tree-tops and branches 3-7 days after emergence from the soil, the females pairing more than once. It has been stated that in the case of *M. melolontha* 2–3 weeks elapse before oviposition, 20–30 eggs are then laid in 2 days, and a second series usually follows of the same number but maturing more quickly. *A. solstitialis* and *S. brunnea* lay only one series, of 25–35 eggs in the case of the former and 12–25 in the case of the latter, 3 weeks after emergence. The females burrow into rather dry soil in a sunny situation and lay their eggs 3–5 inches below the surface, or rather deeper in the case of *Melolontha*. The eggs are scattered singly or in groups of 2–3 within a foot of each other. *S. brunnea* differs from the other species in laying its eggs together in compact balls.

A brief account is given of regular flight years, which are usual on the Continent, but are much less definite in the British Isles, the numbers of beetles that appear being relatively small. It is suggested that the irregularity in the occurrence of flight years of *M. melolontha* is due to annual variations in the British climate, particularly in the spring. The flight years in southern England seem to recur about every 3–4 years, whereas those of *A. solstitialis*, which are much less marked, take place every 2–3 years. *S. brunnea* does not appear to have a definite flight year.

BARNES (H. F.). **I. Insect Fluctuations : Population Studies in the Gall Midges (Cecidomyidae).**—*Ann. appl. Biol.* **23** no. 2 pp. 433–440. Cambridge, May 1936.

ROEBUCK (A.). **II. Fluctuations of Insect Populations : Field Observations.**—*T.c.* pp. 441–444.

The first paper is a review of the results of the author's work on factors affecting populations of Cecidomyiids [*R.A.E.*, A **24** 56, etc.]. In the second, examples of sudden outbreaks are given in the case of a number of insects, including *Blennocampa pusilla*, Klug, *Hylemyia brunnescens*, Zett., and *Psylliodes chrysocephala*, L. Examples are also given of the following more stable species, in which the variations in population from year to year are less marked: *Phyllodecta vulgatissima*, L., *Psila rosae*, F., *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., *Serica brunnea*, L., *Anomala* (*Phyllopertha*) *horticola*, L., *Melolontha melolontha*, L. (*vulgaris*, F.), and *Pegomyia hyoscyami*, Panz., var. *betae*, Curt.

GAUSE (G. F.), SMARAGDOVA (N. P.) & WITT (A. A.). **Further Studies of Interaction between Predators and Prey.**—*J. Anim. Ecol.* **5** no. 1 pp. 1–18, 6 diagr., 5 refs. Cambridge, May 1936.

Recent experimental and mathematical investigations of the nature of interaction between predators and prey arising out of previous work [*cf. R.A.E.* A **22** 347] include observations on the population of two species of mites, one of which, *Cheyletus eruditus*, Schr., feeds upon the other, *Aleuroglyphus agilis*. The effect of properties of the environment upon interaction were analysed by keeping the

mites in various nutritive substances (wheat-flour, millet and semoletta). The predator was found to be much more efficient in the two latter, in which the prey is more available than in the former. As regards the true nature of interaction, it is concluded that under the environmental conditions studied the interaction between the two species of mites forms a relaxation interaction, so that periodic oscillations are prevented after one cycle. When an occasional immigration is allowed, however, such oscillations immediately arise, a new cycle of multiplication of the prey being followed by a new cycle in the growth of the predator population.

NORRIS (M. J.). **Experiments on some Factors affecting Fertility in** *Trogoderma versicolor* **Creutz. (Coleoptera, Dermestidae).**—*J. Anim. Ecol.* **5** no. 1 pp. 19–22, 6 refs. Cambridge, May 1936.

An account is given of experiments proving that the biology of *Trogoderma versicolor*, Creutz., which is sometimes found infesting stored products but has a very short life compared with other Dermestids, is quite comparable with that of *Ephestia kuehniella*, Zell., in which the trend towards total abolition of adult feeding, accompanied by progressive shortening of adult life, has already been studied [*R.A.E.* A **22** 159, 479].

The following similarities found between the two species are taken from the author's summary and conclusions: In the case of each species the life-history is very short compared with most other members of the same order and even of the same family. *T. versicolor* can be reared on a variety of foodstuffs at a high constant temperature, and rearing is not complicated by any tendency to diapause such as is found in many outdoor insects. The adults require neither food nor water for the attainment of their fecundity and longevity, being in this respect even more specialised than *E. kuehniella* in which the fecundity and longevity are very slightly reduced if the adults are deprived of drinking water. Continual pairing throughout the oviposition period is unnecessary in the case of *T. versicolor* for the attainment of full potential fertility.

AHMAD (TASHKIR). **The Influence of Ecological Factors on the Mediterranean Flour Moth,** *Ephestia kühniella* **and its Parasite,** *Nemeritis canescens*.—*J. Anim. Ecol.* **5** no. 1 pp. 67–93, 4 diagr., 31 refs. Cambridge, May 1936.

The following is from the author's summary: The reproductive potential and development of *Ephestia kuehniella*, Zell., are adversely affected by high temperature (above 23°C.[73·4°F.]) and high saturation deficiency (above 14 mm.). Under these conditions the adults exhibit a marked degree of sterility and the larval and pupal stages show a high mortality, but the viability of the eggs is only slightly affected. *Nemeritis canescens*, Grav., being an endoparasite, its reproductive potential is affected neither by saturation deficiency nor appreciably by temperature. *E. kuehniella* possesses two strains, the threshold of development of which lies between 8 and 10°C. [46·4–50°F.], whereas that of *N. canescens* lies between 12 and 15°C. [53·6–59°F.]. In the absence of food, adults of *N. canescens* are only short-lived; by feeding them on honey solution, life is considerably prolonged, the maximum being 80 days at 18°C. [64·4°F.].

At 23°C. and above, on account of its quicker development and higher reproductive potential, the parasite can overtake its host ; at 18°C. and under, the reproductive potential of the parasite falls below that of the host and the rate of development is also greatly reduced. Thus high temperature favours the parasite, low temperature the host.

Whereas the host is susceptible to parasitisation only during a limited period in development, the mixture of strains prevailing results in the continuous presence of the host in the right condition. The long life of the parasite in the presence of food also carries it over, should there be a temporary scarcity of the suitable stage of the host. The parasite is normally positively heliotropic ; the host is negatively so. To this the parasite has adapted itself by becoming negatively heliotropic after feeding.

SPEYER (E. R.). **Entomological Investigations.**—*Rep. exp. Res. Sta. Cheshunt* **21** (1935) pp. 63–78, 3 refs. Cheshunt, Herts., 1936.

In experiments on the infestation of six varieties of carnations by *Thrips tabaci*, Lind. (onion thrips), reproduction proved to be entirely parthenogenetic, confirming previous experience [*R.A.E.*, A **21** 488]. The plants began to flower from the end of May until the beginning of July, and remained in full bloom until well into August. Blooms became fully open 6–10 days after the points of the calyx first separated. *T. tabaci* was introduced at intervals during late May and early June, and during July infested beans were grown among the carnations. Some varieties had 75–85 per cent. of the blooms marked by *T. tabaci*, whilst others appeared to be immune. The thrips may begin to oviposit on the outside of the calyx tube several days before the points of the calyx separate, but apparently prefer the petals when the flower is well open. The damage continues over a long period, and one adult may injure as many as 32 petals before the flower is ready to be marketed. The eggs, some 60 in number, are inserted singly beneath the surface tissues, probably not always all in the same flower, and none was found in the stamens or pistils. Neither eggs nor larvae were found in the foliage or in the bracts at the base of the calyx. The characteristic fleck-marking of the petals and occasionally of the older leaves is due more to the feeding of the adults than of the larvae. Young flowers usually contained one or two adults and old ones as many as four. Adults tended to congregate in over-full blooms, and when one such was placed over a dish of water, 48 larvae left it in 10 days, 11 of them during the first night. A few of these attained the adult stage on the surface of the water, 12 days after leaving the flower. Whilst dusts of pyrethrum or pyrethrum and sulphur proved quite ineffective against the thrips, infestation was reduced on plants sprinkled daily with naphthalene (grade 16) without their being damaged, but it is doubtful whether this method would prove commercially practicable [*cf.* **20** 483 ; **23** 561]. In houses fumigated for red spider mite [*Tetranychus telarius*, L.,] with napthalene (2 lb.–3,000 cu. ft.) on 27th August and 5th September, from 4 p.m. to 9 a.m., the plants showed no signs of subsequent thrips attack, but pupae in the soil probably prevented complete extermination, and younger foliage might not be equally resistant to injury from fumigation.

Experiments were carried out also on the control of *Thrips fuscipennis*, Hal., on roses. Adult thrips were liberated on 28th May, and the plants are thought to have been previously infested. Damage was done to the leaflets by oviposition and the feeding of the larvae, as well as to the flowers later in the season. Dusting with pyrethrum and a pyrethrum-sulphur mixture failed to effect any control [*cf.* **23** 477], and the sulphur scorched the foliage badly. Experiments with bait-sprays containing sodium fluoride showed that treacle was unattractive and white sugar less attractive than brown. A mixture of brown sugar and sodium fluoride in the proportions 3·5 per cent.–0·3 per cent. with 1 per cent. glycerine added to keep it moist after application, which might have reduced infestation, proved to injure the foliage severely.

W. H. Read reports that investigations have been made on the use of derris insecticides for the control of red spider mite [*Tetranychus telarius*, L.] on tomato plants, instead of petroleum oil emulsion sprays, which cause oedema, especially early in the season. Derris dusts were ineffective, but several sprays containing emulsified derris extracts or finely ground derris, with a wetting agent, were successful. The mite was controlled in February by two applications of these sprays (the proportions of which are not given) to badly infested cucumber and tomato plants, but sprays at twice the strength or more failed to give satisfactory control in the summer. Of the other insecticides tested, only one was effective and this, a sulphonated, oxidised petroleum mixture similar to the one tested in 1930 [**19** 639], was found more likely to cause oedema than petroleum oil emulsions, which vary greatly in their harmful effect. A combined insecticide and fungicide mixture, consisting of proprietary " colloidal copper " and a petroleum oil emulsion [**22** 481], has been widely adopted, and in consequence other fungicidal substances have been tried with oil emulsions, including samples of copper oxychloride. Experiments were made with a powder containing sodium cyanide and magnesium sulphate as a fumigant in place of calcium cyanide or sodium cyanide and sulphuric acid. This powder, 1 part of which is equivalent to 0·8 part calcium cyanide or 0·5 part sodium cyanide, proved successful under glasshouse conditions when sprinkled on the floor, provided that the relative humidity was above 70 per cent. and the powder evenly distributed.

HARRISON (G. H.). **Psyllidae in certain Highland Counties.**—*Scot. Nat.* no. 220 pp. 120–122, 3 refs. Edinburgh, 1936.

This list of 24 Psyllids from Scotland includes a record of *Aphalara exilis*, Web.-Mohr., abundant on juniper, pine and spruce in Perthshire and Inverness-shire, this being apparently the first time that hibernating adults have been taken on conifers.

AITKINS (A. E.). **The Spruce Cone Bug,** *Gastrodes abietis* **Linn. (Hemiptera-Heteroptera : Lygaeidae).**—*Ent. mon. Mag.* **72** nos. 865–866 pp. 139–149, 1 pl., 1 map, 3 refs. London, June–July 1936.

In the autumn of 1935, considerable numbers of *Gastrodes abietis*, L. (*abietum*, Bergr.) and *G. ferrugineus*, L., were taken from the cones of *Picea excelsa* (Norway spruce) from the east of Scotland, after these had been dried for some days. The distribution of *G. abietis* is

discussed. In one locality 61 per cent. and in another 97 per cent. of the total number of the two species taken were *G. abietis*. Cones were removed from the tops of standing trees, and some contained both species and others only *G. abietis*. This Lygaeid is probably more closely connected with the young cones, which it preferred, and with the seed than is *G. ferrugineus*, which was more common in the older cones. Eggs were not found, but several nymphs of *G. abietis* comprising four instars were obtained. *G. ferrugineus* lived longer in a dry atmosphere than *G. abietis*. Tests with the feeding of *G. abietis* on seeds of various conifers failed to correlate attack with the low percentage of germination, as had appeared possible on *P. excelsa*. The bug has been shown to damage neither the needles nor the bark [*cf. R.A.E.*, A **22** 141] although these are possibly attacked, but had a tendency to cannibalism. A table is given to distinguish *G. abietis* from *G. ferrugineus*, with descriptions of the 2nd, 3rd, 4th, and 5th nymphal instars and the adult.

James (H. C.). **New Mealybugs from East Africa.**—*Trans. R. ent. Soc. Lond.* **85** pt. 8 pp. 197–215, 16 figs. London, June 1936.

Descriptions are given of 1 new genus and 16 new species of mealybugs, mostly infesting grass roots, in East Africa, including the females of *Trionymus panici* and *Rhizoecus albus* on *Panicum maximum* and *Phenacoccus trispinosus* on the roots and rhizomes of *Solanum tuberosum*, all in Kenya; and *Pseudococcus longirostralis* in Tanganyika and *Trionymus sericeus* in Kenya on the leaves of *Coffea arabica*.

Blair (K. G.). **A new Genus of Strepsiptera.**—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 6. pp. 113–117, 7 figs., 6 refs. London, 15th June 1936.

All stages of the Stylopid, *Corioxenos antestiae*, gen. et sp. n., are described from the Pentatomid, *Antestia orbitalis* var. *lineaticollis*, Stål, on coffee in Tanganyika at an altitude of 4,200 ft. Female hosts usually carry a female parasite on each side, beneath the base of the folded wing and one (or sometimes two) males in the middle. No eggs were found in any female host, and the almost complete occupation of the abdominal cavity of the host by the parasites probably ensures sterilisation. Male hosts have fewer parasites, possibly because they are smaller. In most of the bugs examined the contents of the parasites had been discharged, but in some of the parasites eggs or triungulin larvae were found. In only one case was the male pupa found within the larval skin.

The systematic position of the new genus is discussed.

Nixon (G. E. J.). **Three new Species of Telenominae (Hym. Proctotrupoidea, Scelionidae).**—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 6 pp. 131–134, 3 figs. London, 15th June 1936.

Descriptions are given of the females of *Microphanurus crotius*, sp. n., which was bred from the egg of a Hemipteron (probably a Coreid) on sweet potato in Uganda; *M. suranus*, sp. n., of which three females were bred with a series of *M. seychellensis*, Kieff., from eggs (presumably Hemipterous), and one male and one female from Hemipterous eggs on coffee in Uganda; and *M. sipius* bred from the eggs of *Nezara viridula*, L., in Kenya.

Dustan (A. G.). **Insects attacking the Potato.**—*Publ. Canada Dep. Agric.* no. 505. (Repr. Fmrs' Bull. no. 3) 18 pp., 14 figs. Ottawa, April 1936.

This popular account of the insects infesting potato in different parts of Canada is divided into sections dealing with species attacking the foliage, the stem and the tubers, and, in addition to the control measures recommended against each individual species or group, includes notes on stomach and contact insecticides in common use against potato pests in general.

King (K. M.) & Glen (R.). **The Wireworm Problem in Field Crops of western Canada : A Summary.**—*Saskatoon Leafl Ent. Br. Dep. Agric. Canada,* no. 43, 4 pp. multigraph. Ottawa, May 1936.

This is a popular account, based on 14 years' investigations over wide areas in western Canada, where 15–20 per cent. of the crops on 75 per cent. of the farms is lost owing to damage from wireworms. It describes the symptoms of attack and gives various cultural control measures.

Collier (G. W.) & Robertson (L.). **Adjusting Central Indiana Farming to Corn Borer Conditions.**—*Bull. Purdue Univ. agric. Exp. Sta.* no. 389, 36 pp., 12 figs., 4 refs. Lafayette, Ind., March 1934. [Recd. June 1936.]

In view of the continuous spread of the corn borer [*Pyrausta nubilalis*, L.] on maize from the north-east of the United States, this bulletin discusses the adjustments in harvesting, crop rotation and livestock feeding practices necessary in Indiana to keep in check an infestation that is not yet of commercial importance. Schedules are given for effecting them on various sizes and types of farm.

Chambers (E. L.) & others. **Report of Insect and Plant Disease Control 1933–34.**—*Bull. Wis. Dep. Agric.* no 161a (*Bienn. Rep. 1933–34*), pp. 82–127, text ill. Madison, Wis., February 1935. [Recd. June 1936.]

Notes are given on projects for the control of pests and diseases of plants carried out in Wisconsin in 1933–34, years which proved to be still more favourable to the development of the former than 1931–32 [*cf. R.A.E.* A **21** 453]. Cutworms, armyworms and *Heliothis armigera*, Hb. (*obsoleta*, F.) all appeared 2–3 weeks earlier than normal in 1934 and made a second appearance in equally destructive numbers early in August. The most severe outbreak of grasshoppers ever recorded in the State continued through 1933 and became most serious in 1934, when more than 10,000 tons of poison was distributed for baits. A bait consisting of 1 bushel sawdust, 1 U.S. gal. whey, 1 lb. white arsenic or 1 U.S. pt. sodium arsenite, and ½ U.S. gal. water was substituted for the standard formula, effecting a saving to farmers of over £40,000. The value of crops saved by distribution of bait is estimated at £1,600,000 to £2,000,000. Thorough cleanings of infested maize fields in autumn 1933 and spring 1934 reduced infestation by *Pyrausta nubilalis*, Hb., from 30 farms in 10 counties in 1933 to 2 farms in different counties in 1934. A list is given of the frequency of occurrence of 38 insect pests and plant diseases reported from nurseries.

Control measures employed against the San José scale [*Aspidiotus perniciosus*, Comst.], which has only a limited distribution in Wisconsin, are described. It is not yet established in any of the fruit-growing regions and local increases during 1933-34 have again been due to two long, hot summers followed by mild winters. Damage by *Lachnosterna* spp. has steadily increased over large agricultural and pastoral areas, particularly in the south-western section of the State. The larvae of *H. armigera*, which migrates in the spring from cotton fields in the southern States to maize in Wisconsin, begin to do damage before the tassels appear, boring into the stalk and stunting the crop. Infestations of both field and sweet maize varied from a trace to 50-60 per cent. throughout the State. Infestation of 100 per cent. discovered in shipments of sweet maize received from the southern States before local maize was ready may have had some bearing on its early appearance in the northern States in 1934. A severe outbreak of cutworms in the north-central counties was controlled by the same bait as that used for grasshoppers. The most serious outbreaks of armyworms (*Cirphis unipuncta*, Haw.) ever reported in Wisconsin occurred in 1933 and 1934, when they were recorded for the first time as causing severe injury in the second generation.

Blissus leucopterus, Say, which disappeared 40 years ago, is showing signs of returning, a serious outbreak in the central States having spread northward into Wisconsin. Although the measures taken in 1933 were too late for maximum effectiveness, since migration from small grain to maize had already begun in many localities, infestation did not develop sufficiently except in isolated fields to warrant control measures in Wisconsin in 1934. A serious outbreak was, however, anticipated for 1935 in the counties bordering Illinois, Iowa and Minnesota. The most severe infestations of *Asterolecanium variolosum*, Ratz., yet recorded in Wisconsin occurred there in 1933 and 1934, when a large number of oak trees were killed.

HENDERSON (W. J.). **Yellow Dwarf, a Virus Disease of Onions, and its Control.**—*Res. Bull. Iowa agric. Exp. Sta.* no. 188 pp. 210–255, 20 figs., 11 refs. Ames, Iowa, August 1935. [Recd. June 1936.]

In the course of comprehensive investigations into yellow dwarf of onions in Iowa, which is transmitted by Aphids [*cf. R.A.E.*, A **21** 605, etc.], the author obtained positive results from controlled experiments on transmission of the virus with *Aphis maidis*, Fitch, *Rhopalosiphum prunifoliae*, Fitch, and *A. gossypii*, Glov.

WILBUR (D. A.). **An Outbreak of the Beet Webworm,** *Loxostege sticticalis* **L., in western Kansas in 1934.**—*Trans. Kansas Acad. Sci.* **38** pp. 187–188, 1 ref. Manhattan, Kans., 1935. [Recd. May 1936.]

Salsola pestifer (Russian thistle) was destroyed over wide areas in Kansas in 1934 by the larvae of *Loxostege sticticalis*, L. The outbreak was not, however, considered beneficial in this instance since, owing to a general lack of rough forage throughout the area in 1934, thistles became a valuable crop. The moth has 3 generations a year in Kansas, the third being the most numerous and injurious. The larvae hibernate in the ground in silken tubes and pupate in the spring, the moths emerging in April–May. The larvae of the first generation appear in

June–July, those of the second in July–August and those of the third from moths emerging in August–September may persist until the frosts before hibernating.

West Virginia, Art. 12, Chapt. 19. Insect and Plant Diseases.—34 pp. Charleston, W. Va., West Virginia Dep. Agric. [1935.] [Recd. June 1936.]

This extract from the Code of West Virginia includes the plant pest legislation in force in that State up to June 1934.

Rumbold (C. T.). **Three Blue-staining Fungi, including two new Species, associated with Bark Beetles.**—*J. agric. Res.* **52** no. 6 pp. 419–437, 10 figs., 6 refs. Washington, D.C., April 1936.

Ceratostomella ips, a blue-staining fungus [*R.A.E.* A **20** 172], has been collected in all the Gulf States except Texas, and in Tennessee, Ohio, Wisconsin, and Minnesota. In the east it has been isolated from many species of pine, including *Pinus banksiana*, *P. caribaea* and *P. taeda*, and from the adults of three species of *Ips*. Its association in the west with *I. oregoni*, Eichh., and *I. emarginatus*, Lec., on *P. ponderosa* and *I. integer*, Eichh., on *P. ponderosa* and larch (*Larix occidentalis*) is here recorded. Two new species of *Ceratostomella* were found, *C. pseudotsugae*, sp. n., associated with *Dendroctonus pseudotsugae*, Hopk., in Douglas fir (*Pseudotsuga taxifolia*) and *Larix occidentalis* on the Pacific coast, and *C. piceaperda*, sp. n., with *D. piceaperda*, Hopk., in spruce (*Picea glauca*), in eastern Canada. The beetles carried with them also two types of yeast. The methods of obtaining and maintaining cultures, and technical descriptions of the two new fungi are given. Cultures from beetles resembled those isolated from infested wood.

Parker (D. E.). *Chrysis shanghaiensis* **Smith, a Parasite of the Oriental Moth.**—*J. agric. Res.* **52** no. 6 pp. 449–458, 5 figs., 15 refs. Washington, D.C., April 1936.

Parasites brought to Massachusetts from Japan in 1932 included *Chrysis shanghaiensis*, Smith, which, in Eastern Asia, parasitises *Monema* (*Cnidocampa*) *flavescens*, Wlk., a pest of various shade and fruit trees [*R.A.E.*, A **21** 438]. Liberations made in 1917 and 1918 [**8** 310] failed to establish the parasite. It was reared in the insectary from 1932 until the winter of 1933–34, when all the hibernating larvae were killed by cold. The general habits of Chrysidids, and the distribution of *C. shanghaiensis*, are reviewed from the literature, and the immature stages of the latter are described. The adults seek seclusion in dull weather, but are very active when the temperature is high. The females mated readily in cages, but never more than once. When the female is ready to oviposit, it pierces the end of a cocoon of *M. flavescens*, taking 10–30 minutes to do so. If the cocoon is less than 24 hours old, it is not sufficiently hard and the parasite leaves without depositing any eggs. Oviposition requires 6–30 minutes, and sealing the hole, 9–37 minutes. Under laboratory conditions 7 females laid an average of 11·3 eggs each, but this may be less than under natural conditions. The larvae hatch after 4 days. The first larval instar averages 4 days, and each of the 3 intermediate and the final instars 3 days. The mature larvae

overwinter in cocoons within the host cocoons. Pupation takes place late in June, and the pupal period lasts a month or more. The adults lived for several months when fed on honey and water (1 : 4) or lump sugar and water in a heated insectary. Of 97 adults that emerged between 26th July and 24th August, only 9 had died on 10th October, and the last died on 20th January.

Uncompleted experiments on the interrelation of *C. shanghaiensis* and *Chaetexorista javana*, Br. and Berg., an internal parasite of the larvae of *M. flavescens* in their cocoons [**21** 233], indicated that competition probably exists between the two species. Several immature *Chrysis* in unsealed cocoons were devoured by the larvae of *Melittobia* sp., but it is believed that this Eulophid would be unable to oviposit in a normal cocoon. Overwintering *Chrysis* larvae survived a temperature of —4°F., but were killed when the temperature fell to —18°F.

Fleming (W. E.) & Baker (F. E.). **The Effectiveness of various Arsenicals in Destroying Larvae of the Japanese Beetle in Sassafras Sandy Loam.**—*J. agric. Res.* **52** no. 7 pp. 493–503, 1 fig., 9 refs. Washington, D.C., April 1936.

An account is given of studies made from 1929 to 1935 on the relative effectiveness of the inorganic arsenates and arsenic trioxide in the soil against the larvae of *Popillia japonica*, Newm. [*cf. R.A.E.*, A **14** 526]. In the experiments, the temperature, moisture and food in the soil were controlled, and larvae of the same origin and instar were used. More than 18,000 tests with 90,000 larvae were made, using aluminium, barium, dicalcium, tricalcium, ferric, magnesium, manganese and zinc arsenates, acid and basic lead arsenates and arsenic trioxide, the compositions of which are given. The insecticides were mixed with soil at the rate of 250, 500, 1,000, 1,500, and 2,000 lb. per acre (to a depth of 3 ins.), and each batch was placed in 20 5-inch pots, an equal number of pots being filled with untreated soil as controls. Grain was sown in each of the pots, which were then placed in moist peat in a room at constant temperature. After 48–72 hours, when the soil was at the proper temperature and the grain had sprouted, 5 active 3rd instar larvae were placed in each pot. Seven days later the soil was removed from each pot, the numbers of dead and living larvae recorded, and the living larvae and soil replaced, to be examined after another seven days. Materials considerably more effective than acid lead arsenate, which was the standard, were compared with the standard at the end of the first seven day period, and other materials at the end of the second period. The median concentration of an insecticide is defined as that concentration which causes the death of half the larvae in the soil, and it is calculated from the nearest concentrations used experimentally that gave a greater and a less mortality. The co-efficient of effectiveness of the insecticide is the ratio of the median concentration of the standard with its error to that of the insecticide with its error. The coefficients of various arsenicals were determined immediately after application, and at intervals for 60 months.

The results are analysed statistically. Almost 90 per cent. of the variance in the co-efficients of acid lead arsenate, magnesium and zinc arsenate, and more than 60 per cent. of that of the other arsenates could be accounted for by the period the materials had been in the soil, but only 1·2 per cent. in the case of arsenic trioxide. The most

important factor associated with the effectiveness of the arsenates was therefore the length of the time they had been in the soil, but other factors were more important with arsenic trioxide. Basic lead arsenate was valueless as a soil insecticide. Ferric arsenate was significantly less effective, and the other materials significantly more effective than acid lead arsenate when freshly applied to the soil. There was no correlation between the water soluble arsenic oxide content or the arsenious oxide content of the materials and their effectiveness. As 45·2 per cent. of the variance in the coefficients could be accounted for by the total arsenic oxide content of the materials, this must have some influence, although other properties of the materials are more important in modifying the insecticidal action. Magnesium arsenate and dicalcium arsenate decreased in effectiveness more rapidly than acid lead arsenate, but no significant difference in the rate of change could be shown with the other materials. As there was little loss in the total arsenic content of the soil under the experimental conditions during a period of 60 months, the decrease in effectiveness may be due to the slow conversion of arsenic into a form, possibly a complex basic salt, that is not toxic to the insect. In the field it is more certainly due to the removal of the arsenic by leaching and to its conversion to an ineffective form.

WHITCOMB, jr. (W.). **The Wax Moth and its Control.**—*Circ. U.S. Dep. Agric.* no. 386, 13 pp. Washington, D.C., April 1936.

An account is given of *Galleria mellonella*, L., and its control in the United States [*cf. R.A.E.* A **8** 22, etc.]. Owing to the longer season and apiary practices followed in the Southern States, losses due to damage by this moth are considerably higher there than in the north. In addition to the complete destruction of colonies, many combs may be ruined by the larvae even when the colony is of fair strength. The eggs are probably laid on the section boxes before the comb honey supers are removed from the hives, and injury to comb honey by the larvae, consisting of borings through the wax caps of the cells, is probably caused some time after it has been placed in storage. In cases where weak colonies die out during winter storage, larvae of *G. mellonella* often destroy the combs before the death of the colony is noticed. The destruction of combs by the wax moth, has, however, tended to prevent the keeping of bees in box hives and to improve general beekeeping practices. *G. mellonella* also helps to destroy combs in inaccessible places that might harbour germs of brood diseases, but the benefits brought about by the moth are small compared with the losses it causes.

All stages of *G. mellonella* are described. At 75–80°F. the eggs hatch in 5–8 days, but at 50–60°F. the period may extend to 35 days. Egg masses are found on the comb, edges of the frame and in portions of the hive farthest from the light. The larvae attempt to burrow into the wax almost immediately after hatching. The length of the larval period from the hatching of the egg until pupation ranges from 28 days to 4–5 months. The larvae probably feed mainly on the impurities in the wax; the attack is chiefly directed against the midrib and bases of the cells, the cappings of cells containing sealed brood being sometimes destroyed. Though the larvae mostly avoid pollen, they can eat it and develop on it. Their mortality when developing on foundation is high, their developmental period is long

and the resulting adults small and white. Damage reported as caused by *Achroia grisella*, F., in Louisiana is probably due to such poorly fed larvae of *G. mellonella*. Larval development is favoured by the normal temperature of the beehive during the active season (85–95°F.). Development is slower at lower temperatures, and at 40–45°F. the larvae seem to become altogether dormant. They migrate considerable distances and spin a dense, tough, silken cocoon before pupating. The pupal cases may be found beneath the hive or on protected portions of the hive stand. The pupal stage within the cocoon lasts 8–62 days according to temperature, adults emerging throughout the winter in the south. The female begins to deposit eggs 4–10 days after emergence and continues to do so while vitality lasts, as many as 102 eggs having been deposited by a single female in one minute. The total number laid varies considerably under laboratory conditions, but is usually less than 300. *G. mellonella* appears to be always present, without definite generations, in the Southern States [*cf.* **2** 379]. In addition to injury by this moth and to a less extent by *A. grisella*, some damage is done to combs by *Ephestia kuehniella*, Zell., which bores tunnels through the midrib, and consumes food intended for developing bee larvae in brood cells.

When the colony is strong, the bees themselves are the most effective natural enemies of *G. mellonella*. *Monomorium* sp. has been effective in controlling the moth in laboratory experiments by feeding on resting adults during daylight, though this ant does not appear to attack larvae in combs. Control measures under apiary conditions consist in keeping the colonies strong and the hives clean. When on equipment in storage, the moth may be controlled by the use of paradichlorobenzene fumigation, which destroys adults and larvae but is not effective against the eggs. Treatment may be made without taking the infested material out of doors, the joints between the supers being sealed with gummed paper tape to make them airtight and the crystals being sprinkled directly on the top bars of the frames.

WARDLE (R. A.). **General Entomology.**—Demy 8vo, vii+311 pp., 96 figs. Philadelphia, Pa, P. Blakiston's Son & Co., 1936. Price $2.25.

This textbook, which constitutes a broad appreciation of the basic principles of entomology, omitting details of insect morphology and classification requisite for a training in professional entomology, is intended to form part of a course of zoology or agriculture. After dealing with the external and internal anatomy, the development and life-cycle, physiology and behaviour of insects generally, the author traces the successive changes made in the classification of insects, and finally recognises 40 orders, 12 of which are now represented only by fossils, and discusses them under 10 groups with a view to bringing out their phylogenetic affinities.

GNADINGER (C. B.). **Pyrethrum Flowers.**—2nd edn., Demy 8vo, xvi+380 pp. frontis., text ill., 991 refs. Minneapolis, Minn., McLaughlin Gormley King & Co., 1936. Price $5.50.

In this second edition of a work already noticed [*R.A.E.*, A **22** 457], data on production and new sources of pyrethrum have been brought up to date, recent work on the isolation of the pyrethrins and on pyrethrum dermatitis is described, and working descriptions of 14

chemical methods for assaying pyrethrum products are included. The decomposition of pyrethrum flowers and extracts in storage and the use of antioxidants to prevent decomposition are discussed. Fresh information on live stock sprays and the cultivation of pyrethrum in the United States is given, as well as more than 300 additional references.

DUSTAN (A. G.). **Controlling the *Gladiolus* Thrips.**—*Yearb. New Engl. Gladiol. Soc. 1936* typescript extract 8 pp. Boston, Mass, 1936.

Most of the information in this review of chemical and cultural measures for the control of *Taeniothrips simplex*, Morison (*gladioli*, Mlt. & Stnw.) in Canada has already been noticed [*cf. R.A.E.*, A **21** 319; **23** 284, 756, etc.]. The tops of *Gladiolus* plants should be cut at harvest as near the corms as consistent with safety, and the corms should not be allowed to dry in the *Gladiolus* bed, where they would be exposed to infestation by the adults which are then in flight. In districts where *T. simplex* is able to live through the winter in the open, all tops and discarded corms should be immediately burned.

FERRIS (G. F.). **Contributions to the Knowledge of the Coccoidea (Homoptera).**—*Microentomology* **1** pp. 2–16, 17–92, 74 figs. Stanford Univ., Calif., January–May 1936.

The first contribution contains descriptions of 11 scale insects and an Aphid erroneously described as a scale insect, 10 of which were described by Maskell in 1897–98 from material collected by Koebele and now mostly in the Stanford Natural History Museum.

In the second contribution illustrations are given of 61 genotypes of Diaspine Coccids, with preliminary observations on the limits of the genera concerned, brief notes on their morphology, and a table of the generic names.

DHARMARAJULU (K.). **The Nature of Resistance in Cotton Plants to Stem-weevil.**—*Proc. Ass. econ. Biol. Coimbatore 1935* **3** pp. 21–31, 3 pls., 8 refs. Coimbatore, 1936.

Experiments show that the resistance of Cambodia cotton to attack by *Pempheres affinis*, Fst. [*cf. R.A.E.*, A **22** 517 etc.] takes two forms, the production of a gall and the exudation of gum. An account is given of the histology of these processes. The gall development took place in definite stages, the earlier ones following the general line of wound repair. The production of gum was directly dependent on the proliferation of tissue. The parenchyma of the callus disintegrated and flooded the gallery with the gum.

RUSSELL (T. A.). **Plant Pathological Report, 1935.**—*Rep. Dep. Agric. Bermuda 1935* pp. 18–23. Hamilton, 1936.

Amongst insect pests observed in Bermuda during 1935 were *Thrips tabaci*, Lind., which damaged onions severely, *Dialeurodes citrifolii*, Morg., which attacked *Citrus*, and *Phthorimaea operculella*, Zell., which was destructive to stored potatoes and also attacked tomatos, but less severely than in previous years [*cf. R.A.E.*, A **24** 305]. *Pheidole megacephala*, F., was found apparently preying on the larvae of the latter among potatoes. *Ceratitis capitata*, Wied., was scarce, most of the

larvae being found in sweet pepper (*Capsicum frutescens*), which fruits throughout the year and may thus enable this fly to survive. The parasite, *Opius humilis*, Silv., was again recovered from larvae infesting peppers [*cf.* **22** 655]. Tests with two dusts (Drymac and Rotodust) containing unstated quantities of derris, showed that three applications of either to cabbages gave a significant degree of control of *Plusia* (*Autographa*) *brassicae*, Riley, but infestation was so light on control rows that the expense of commercial dusting might not have been justified. Nicotine dust, naphthalene flakes and a spray of 1 oz. Paris green in 3 gals. water to which molasses was added, were tried unsuccessfully against *T. tabaci* on onions. Larvae of the black onion fly, *Tritoxa flexa*, Wied., were intercepted in a consignment of chives from the United States.

Pickles (A.). **Observations on the early Larval Mortality of certain Species of *Diatraea* (Lepid., Pyralidae), under Cane Field Conditions in Trinidad.**—*Trop. Agriculture* **13** no. 6 pp. 155–160, 2 diag., 16 refs. Trinidad, June 1936.

Investigations were carried out in Trinidad on the life-history and larval mortality of *Diatraea saccharalis*, F., *D. canella*, Hmps., and *D. impersonatella*, Wlk., with a view to comparison with data on the first-named species from Antigua and Barbados. It is pointed out that many insect species occupy an environment the physical conditions of which are barely tolerable to them, and survive only because a few of their numerous progeny take advantage of chance fluctuations in that environment. Thus the natural death-rate of many insect pests, such as *D. saccharalis*, is high [*cf. R.A.E.*, A **21** 543; **22** 325]. The author shows (by algebraic methods) the mathematical possibility of R. W. E. Tucker's statement [**19** 105] that a sensible reduction in damage to sugar-cane in Barbados resulted from the mass liberation of *T. minutum*, Riley, against the eggs of *D. saccharalis* causing an increase of 11·1 per cent. in parasitism. This statement has frequently been criticised on the grounds that since about 90 per cent. of eggs die normally an increased parasitism of 11·1 per cent. would only lead to a very slight increase in the " real mortality " [*cf.* **18** 125; **21** 543].

Rearing experiments in the laboratory provided the following data necessary for the estimation of the larval mortality of the three species, *saccharalis*, *impersonatella* and *canella*, in the field: the incubation periods were 6, 6, and 7–8 days respectively, the larval periods 39 days (with 7 instars), 22–53 days (mean value 37 days), and 48–68 days, and the pupal periods 9, 9–11, and 12 days. Thus no pupae found in the field could possibly be derived from eggs laid during the same month. To ascertain the mortality, small plots of cane were examined twice weekly for eggs, all egg-clusters being marked and their history followed. After a month the canes were harvested and examined. Three plots, each containing a maximum of 30 stools, were selected at random, and observed over a period of 8 months. From the number of eggs which had hatched normally during each month and the surviving larvae, the number which had died was deduced. The most representative figure for the percentage larval mortality was the mean from the three random plots. It varied over the period June–January from 40·04 to 95·56, with a monthly average of 81·75. Assuming that the mortality in the four months not covered by these records was 100 per cent., the mean value for one year in Trinidad was greater

than the value for Barbados (estimated on the same assumption for three months) and less than that for Antigua. The figures are not strictly comparable because of climatic differences between the islands and different methods of cultivation, and also because in Barbados and Antigua only *D. saccharalis* was concerned, whereas in Trinidad this was the least plentiful of the three species involved. In Trinidad there was a correlation coefficient of 0·811 between the number of eggs laid and the larval mortality in the same month. This shows a positive correlation which might also obtain under Barbados conditions. It may possibly be explained by competition for feeding areas between the larvae themselves, which would result in more intense competition when the early larval populations are large ; in this case the coefficient should be higher when the number of larvae actually hatched is compared with the larval mortality than when the number of eggs laid is so compared. In the latter case the coefficient is 0·811 and in the former 0·781. Another possible explanation may be that some climatic factor favours oviposition but not larval development.

ROSEL (A.). **An early Occurrence of *Lyctus* or the Powder Post Borer in Victoria.**—*J. Coun. sci. industr. Res. Aust.* **9** no. 2 p. 142. Melbourne, May 1936.

Evidence has been obtained that the timbers (*Eucalyptus obliqua*) in the roof of a cathedral in Melbourne had been infested with *Lyctus brunneus*, Steph., prior to its erection in about 1865, and at about the same time (1862) as infestation was first recorded in Western Australia.

ATHERTON (D. O.). **Leaf Miner and Stem Borer of Tobacco in North Queensland.**—*Qd agric. J.* **45** pts. 1–4 pp. 12–31, 131–145, 239–248, 331–344, 46 figs., 1 fldg. graph, 59 refs. Brisbane, January–April 1936.

The following is mainly taken from the author's summary: *Phthorimaea operculella*, Zell., and *P. heliopa*, Lw., are two of the more destructive insect pests of tobacco in North Queensland, where the area under cultivation has recently increased. *P. operculella* is probably indigenous in tropical America, but is now cosmopolitan. *P. heliopa* apparently does not occur in that continent, but seems to be indigenous in many countries bordering the Indian Ocean. The present distribution of both species is noted. Native and cultivated food-plants of *P. operculella* are enumerated. No record of a food-plant other than tobacco was found for *P. heliopa*, but two native species, *Nicotiana suaveolens* and *N. glauca*, are now recorded from North Queensland for the first time.

All stages of both pests are briefly described and the original descriptions are quoted. Notes are given on the bionomics of each stage, and particularly on the injury caused by the larvae of each species, which are discussed at length in regard to the relation of temperature to their development, their agreement with Dyar's hypothesis and general habits. *P. operculella* has 4 larval instars, whereas *P. heliopa* has 5, larvae of the former requiring 351±33 effective day-degrees F. for development and *P. operculella* 703±81, assuming the threshold of development to be 52°F. Neither species consumes any of the epidermal portion of the food-plant, which the larvae reject

after biting it away when initiating attacks through the leaves or other parts of the plant.

The habits of the adults are described with notes on flight and oviposition. *P. heliopa* habitually oviposits on the food-plant, but *P. operculella* seldom does so, preferring the ground near its base. Females of *P. heliopa* lay up to 400 eggs [*cf.* **18** 159], those of *P. operculella* only up to 163. The adults seek seclusion during the greater part of the day. Under normal local conditions *P. operculella* has 10–11 and *P. heliopa* 7–8 generations annually. The two species will not interbreed. *P. heliopa* invariably pupates within the food-plant, where it is protected from outside agencies until the moth emerges, whereas *P. operculella* usually pupates on the ground or in débris at the base of the plant, though sometimes on the outside of the stem. Both species cause serious losses in seed-beds, the presence of *P. operculella* being always obvious, whereas that of *P. heliopa* may not be apparent until after the plant has been set out in the field and a typical gall develops. *P. heliopa* alone can seldom destroy a whole crop, as can *P. operculella*. The critical stage occurs during the period of suspended growth immediately after transplanting. Whereas in the laboratory both sexes of *P. operculella* were positively phototropic, most individuals of *P. heliopa* gave a negative response to light. Moths of *P. operculella* lived up to 60 days with an average of 38 days in the laboratory, but *P. heliopa* only 21 days at most, with an average of 18 days. Average oviposition of fertilised females in one series of observations was 238 eggs for *P. heliopa* and 65 for *P. operculella*. Parasites of *P. operculella* are quoted from the literature, though they have not been recorded from Australia. There are no larval parasites of *P. heliopa* recorded from other countries, but several, including 3 Braconids as yet unidentified, are now recorded from Queensland, one of them also parasitising *P. operculella*.

Control measures tried successfully include the use of moth-proof covers to prevent infestation of seed-beds [**21** 64] and the application of lead arsenate dust twice a week, which reduced attack by the larvae of *P. heliopa* on treated leaves by about 60 per cent., a 50 per cent. concentration being found best. Two copper sprays developed for the control of *Peronospora tabacina* in seed beds gave considerable control of both species. It was proved in the laboratory that the effect of these sprays was not ovicidal, nor were larvae entering sprayed leaves killed, so that they probably had some deterrent action on gravid females. Unsuccessful measures tried were honey and water and molasses and water baits, acetylene lamps used as light traps, and lead arsenate applied as a spray at the rate of 1½ oz. per gallon of water, against *P. operculella*. Legislation enforced in 1933 for the removal of crop residues is quoted, and the advisability of introducing some of the parasites of *P. operculella* credited with partial control of this species in other countries is discussed.

Lever (R. J. A. W.) & Phillips (J. S.). **Further Experiments with *Amblypelta* and immature Nutfall.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 4 Suppl. pp. 4–5, 2 figs. Tulagi, February 1936. [Recd. June 1936.]

Experiments continued on two islands on *Amblypelta cocophaga*, China [*R.A.E.*, A **24** 120 ; 328, etc.], which causes the fall of immature coconuts, showed an induced fall of 89 per cent. and a natural fall of

63 per cent. Certain islands are free from the pest. In addition to food-plants already noted, *A. cocophaga* was found on *Poinciana regia*. The identification of the egg-parasite as *Anastatus axiagasti*, Ferrière [**23** 634] is confirmed.

L[EVER] (R. J. A. W.). **Control of *Brontispa* in Celebes by the Parasite *Tetrastichodes* of Java.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 4 Suppl. p. 6, 2 figs. Tulagi, February 1936. [Recd. June 1936.]

A consignment of *Tetrastichodes brontispae*, Ferrière, has been imported from Java in pupae of *Brontispa froggatti* var. *selebensis*, Gestro, which it controlled successfully in Celebes [*R.A.E.*, A **23** 509], in hopes of controlling the typical species in the Solomon Islands.

ARK (P. A.) & THOMAS (H. E.). **Persistance of *Erwinia amylovora* in certain Insects.**—*Phytopathology* **26** no. 4 pp. 375–381, 14 refs. Lancaster, Pa, April 1936.

An account is given of experiments under laboratory conditions to test the part played by insects in the transmission of *Bacillus* (*Erwinia*) *amylovorus* (fire-blight) using *Drosophila melanogaster*, Mg., *Musca domestica*, L., *Lucilia sericata*, Mg., and honey bees.

The following is the authors' summary. Larvae of *D. melanogaster* and *M. domestica* after feeding on a medium contaminated by *B. amylovorus* were found to contain the organism in their internal organs. The bacteria persisted through the pupa to the adult in both of these flies. Eggs of *M. domestica* from contaminated females carried the organism externally but not internally. Adults of *D. melanogaster*, *M. domestica* and *L. sericata* harboured the organism internally for 6, 3 and 4 days respectively. The bacteria remained viable in the viscera of honey bees for 48 hours, but were not recovered from their heads after 12 hours from the time of contamination.

YOUNG (H. C.) & BECKENBACH (J. R.). **Spreader Materials for insoluble Copper Sprays.**—*Phytopathology* **26** no. 5 pp. 450–455, 1 graph, 1 fig., 2 refs. Lancaster, Pa, May 1936.

An investigation to discover the best spreader for insoluble copper sprays showed bentonites to be most widely used. Their jelling property causes a type of flocculation such as occurs in Bordeaux mixture, which gives excellent spreading and sticking. They are practically inert chemically and are good absorbers, which makes them useful when mixed with soluble or gaseous forms of fungicides, or insecticides such as zinc sulphate, pyrethrum, cryolites, or fluorides, nicotine, etc. There is variation in efficiency in the bentonite group. Of those studied, the Wyoming bentonite gave excellent results.

GÜSSOW (H. T.). **Plant Quarantine Legislation—a Review and a Reform.**—*Phytopathology* **26** no. 5 pp. 465–482. Lancaster, Pa, May 1936.

The review is divided into 3 sections dealing respectively with embargoes generally, health certificates and conditional and restrictive measures. Suggested reforms, most of them international, include plant-disease surveys ; suspervision of exports, including material other

than living plants, such as packing materials ; limits of tolerance and standards ; insurance against interceptions ; agreements on regulations dealing with import and export among groups of countries of similar interests and geographical position ; co-operation in scientific research ; and the formation of an international advisory council on plant quarantines.

ZAUMEYER (W. J.) & KEARNS (C. W.). **The Relation of Aphids to the Transmission of Bean Mosaic.**—*Phytopathology* **26** no. 7 pp. 614–629, 11 refs. Lancaster, Pa, July 1936.

In practically all the bean-growing areas of the United States, bean mosaic is a major factor in reduction of yield, and seed-transmission of the virus cannot entirely explain its rapid and widespread dissemination during certain seasons. In Colorado and Virginia a study was made of the transmission of the virus by 12 species of Aphids taken from 17 different food-plants and 10 other species of insects that are commonly collected from bean fields. Aphids were not found in large numbers on beans in the field. Maximum infestation usually occurred about 10 days after the beans were above ground, the numbers decreasing as the season progressed. Positive transmission of the virus of the mosaic was obtained in cages in a greenhouse with 11 of the species of Aphids. Only *Periphyllus* (*Neothomasia*) *populicola*, Thom., from *Populus deltoides* (cottonwood tree) gave negative results as did all the other species of insects tested. The literature on insect transmission of the virus is briefly reviewed.

OTANES (F. Q.). **Some Observations on two Scale Insects injurious to Mango Flowers and Fruits.**—*Philipp. J. Agric.* **7** no. 1 pp. 129–141, 7 pls., 21 refs. Manila, 1936.

In view of the fact that the drying up of mango flowers in the Philippines may be due to a disease transmitted by insects, notes are given on the occurrence and control of *Puto spinosus*, Robinson, and *Coccus mangiferae*, Green, on mango, of which short descriptions are given. Both species were associated with the red tree ants, *Oecophylla smaragdina*, F., and were taken in their nests. According to Takahashi they both also occur in Formosa, though the food-plant of the former is unknown there. *P. spinosus* in some mango trees was more numerous than the mango hoppers, *Idiocerus* (*Chunra*) *niveosparsus*, Leth., and *I. clypealis*, Leth., and has also been collected from *Buchanania arborescens*. It is probably parthenogenetic. From rearing records obtained under greenhouse conditions, two months elapsed between the appearance of the scales and the production of young. The flowers attacked by *C. mangiferae* withered and fell, and sooty mould covered the leaves bearing honey dew, the injury resembling that by the hoppers.

Scymnus bipunctatus, Kug., preyed on *P. spinosus* in the laboratory, but has not been observed to do so in the field. Hymenopterous parasites, including *Coccophagus tibialis*, Comp., were reared from *Coccus mangiferae*. Specimens of *C. mangiferae* from nests of *O. smaragdina* were also parasitised.

Spraying with 0·3–0·5 per cent. soap solution was ineffective, but a spray containing about 7 oz. dry soap in 5 U.S. gals. water killed all stages of both scales that were wetted by the spray, but injured the flowers in bloom. It is therefore suggested that the young growths

should be sprayed before the Coccids transfer to the flowers, and before these open. Control of *O. smaragdina* would also help, though it may possibly be beneficial by killing other mango pests.

Other insects attacking the flowers of mango include *Chlumetia transversa*, Wlk., *Eutelia* sp., and *Monolepta bifasciata*, Hornst.

KATÔ (Mutsuo). **On the Activity of Oviposition of the Strawberry Weevil, *Anthonomus bisignatus* Roelofs.**—*Sci. Rep. Tôhoku Univ.* (4) **10** no. 4 pp. 697–708, 7 figs., 5 refs. Sendai, March 1936.

Notes are given on oviposition in *Anthonomus bisignifer*, Schenk. (*bisignatus*, Roel.) on strawberry in Japan, and the effect of climatic factors on it. This occurs from the beginning of May to mid-June. Usually a single egg is inserted in each flower-bud, the pierced buds falling to the ground. Having selected a strawberry plant on which to lay its eggs, the weevil seldom moves to another. The injury done was uniform in each row, and almost in each plant. Egg-laying activity was stimulated by sunshine, high temperature and low humidity, and inhibited by rainfall.

REÁTEGUI PAGE (N.). **La explotación del barbasco en el departamento de Loreto.** [The Exploitation of Barbasco in the Department of Loreto.]—*Bol. Direcc. Agric. Ganad. Peru* **5** no. 19 pp. 55–59. Lima, 1935. [Recd. June 1936.]

Though several other varieties occur in Loreto, Peru, *Lonchocarpus nicou* (Huasca Barbasco), which appears to grow best under shade, contains the highest percentage, 5 to 15, of rotenone [*R.A.E.*, A **22** 109]. Particulars are given of the loss in weight when the roots are dried, which must be done slowly to avoid fermentation and moulds, and of the characters differentiating *L. nicou* roots from those of other varieties.

LAMAS C. (J. M.). **Los insectos del agodonero en los valles de los departmentos de Lambayeque y la Libertad.** [Cotton Insects in the Valleys of the Departments of Lambayeque and Libertad.]—*Bol. Direcc. Agric. Ganad. Peru* **5** no. 19 pp. 60–63. Lima, 1935. [Recd. June 1936.]

In July 1935 *Dysdercus ruficollis*, L., occurred in all the valleys on wild malvaceous plants and on cotton, 75 per cent. of the bolls being infested in some cases. In one locality cotton plants 2–3 weeks of age were killed by *Gasterocercodes gossypii*, Pierce, in fields where ratoon had been infested in the preceding year. Old plants must be uprooted completely after the harvest. A wild malvaceous plant, *Malachra* sp., growing in fields of rice stubble, was one of the principal food-plants of *G. gossypii*.

Other pests of cotton included *Anthonomus vestitus*, Boh., *Pinnaspis* (*Hemichionaspis*) *minor*, Mask., *Mescinia peruella*, Schaus, *Tetranychus* sp., and *Anomis luridula*, Gn. (*texana*, Riley). The last-named was parasitised by *Rhogas* sp. and *Eucelatoria australis*, Tns. [*R.A.E.*, A **22** 474].

Pests of *Citrus* were *Icerya purchasi*, Mask., *Lepidosaphes beckii*, Newm., *Selenaspidus articulatus*, Morg., *Coccus* (*Lecanium*) *hesperidum*, L., *Prontaspis* (*Chionaspis*) *citri*, Comst., and the larvae of *Papilio thoas*, L.

VOÛTE (A. D.). **Die beschaedigung der mangabaeume von fruchtfressenden insekten.** [The Injury done to Mango Trees by Fruit-eating Insects.]—*Natuurk. Tijdschr.* **96** no. 2 pp. 139–144, 2 graphs, 4 refs. [Batavia, 1936.]

Following Franssen's paper on the mango fruit borer, *Philotroctis eutraphera*, Meyr., in Java [*R.A.E.*, A **23** 439], the author discusses the question whether the insects that attack mango fruits affect the numbers that mature. The tree bears a great number of fruits, most of which gradually drop off, the fall ceasing when those left are quite or nearly full-grown. It is probable that those falling do so from lack of nourishment and that the consequent thinning out alone enables those remaining to mature. As only quite young fruits are attacked by *P. eutraphera*, this Pyralid must cause an exceptional number to fall before actual loss results. In the case of another Pyralid, *Noorda albizonalis*, Hmps. [**18** 460], both large and small fruits were infested, and attack, when the natural fall had decreased, caused losses for which the tree could perhaps not compensate. *Cryptorrhynchus gravis*, F., infests the fruits [**24** 198] without causing them to drop, so that no compensation is possible. Whether this weevil reduces the number of fruits capable of germination is unknown, but the infested fruits are unfit for consumption.

DE FLUITER [H. J.]. **Waarnemingen in Nederland over** *Gilletteella cooleyi* **Gillette, de Douglaswolluis.** [Observations in Holland on *Chermes cooleyi*, the Douglas Fir Woolly Aphis.]—*Tijdschr. Ent.* **77** pp. lxviii–lxxiv. Amsterdam, 1934. [Recd. July 1936.]

Attention has been drawn to the spread of *Chermes* (*Gilletteëlla*) *cooleyi*, Gill., on Douglas fir [*Pseudotsuga taxifolia*] in Holland [*R.A.E.*, A **22** 665]. A list is given from the literature of the forms of this Aphid on the primary food-plants (*Picea*) and the secondary food-plant (*Pseudotsuga*). In the United States the sexuales are unknown, though they must occur, being the starting point of the developmental cycle on *Picea*. Chrystal & Story studied *C. cooleyi* in Great Britain on Douglas fir only, because the sexuales on Sitka spruce, *Picea sitchensis*, failed to produce offspring [**10** 605], so that up to now the generations on Sitka spruce have been known from America only.

C. cooleyi was first recorded in Holland in 1928. During observations by the author in 1933 [**22** 665], the various Douglas firs were found to differ in susceptibility to infestation, *Pseudotsuga taxifolia glauca* never being attacked. A Douglas fir twig received on 5th April 1934 was infested by first- and second-stage larvae. On material received on 18th April the Aphids were already full-grown and had laid eggs. The development of the first generation after hibernation had therefore taken about 18–20 days. On Douglas fir twigs received on 26th April there were numerous eggs (about 60 per female) and also eggs of the Coccinellid, *Anatis ocellata*, L. On 27th April the first Aphid eggs hatched out, and on 29th April the first of those of the Coccinellid, the larvae of which fed on all stages of *C. cooleyi*. On 1st May first-stage larvae of the second generation of *C. cooleyi* were very active, spreading over whole twigs and concentrating on the shoots. Infested twigs were placed on young " coast " Douglas firs and other Douglas firs in a greenhouse. The former became very heavily infested and some wingless, full-grown individuals of the second generation were found.

On the latter only a few larvae, still in the first stage, were alive and secreting some honey dew, and the dead ones were already shrivelled up. On 1st June nearly all larvae on the young shoots of one " coast " Douglas fir had given rise to winged forms and nearly all on another to wingless individuals. On the old needles there were still many first-stage larvae, all alive and secreting honey dew in abundance. They resembled larvae in the hibernation stage. On the other Douglas firs, the young shoots were not so far developed and all the larvae were still in the first stage and mostly on the old needles. Many were dead. On 4th June twigs of Douglas firs were received on which the young, current year's shoots were heavily infested with nymphs, young larvae and eggs.

On 2nd June a gall was found on Sitka spruce very strongly resembling that of *C. cooleyi* on that variety of spruce illustrated in the literature. If it is identical this would be the first record of *C. cooleyi* from Sitka spruce from Europe [*cf.* **23** 718], and this spruce will perhaps become as important in the spread of this Aphid as it is in America.

TROUVELOT (B.). **Remarques sur l'écologie du doryphore en 1935 dans le massif central et le centre de la France.**—*Rev. Zool. agric.* **35** no. 3 pp. 33–37. Bordeaux, March 1936. [Recd. June 1936.]

Studies on the seasonal history of the potato beetle [*Leptinotarsa decemlineata*, Say] in the west and central districts of France during 1935 showed that the adults mostly emerged from the soil when the mean temperature of the air was about 15°C. [59°F.]. As the subsequent migration to uninfested fields took place only on warm days, it continued over several weeks when these were infrequent. There was no correlation between the emergence and migration of the insects and the growth of the potatoes. Flights were particularly marked in the east and south of the area under consideration, possibly because of the sudden changes of temperature and pressure resulting in fine days directly after cold damp weather. The heavy oviposition period was preceded by a lighter one, the interval being short when the rise in temperature during the spring was rapid, and long (a month or more) when the rise was early but not intense and progressed slowly. Heavy egg-laying occurred particularly after a steady heating of the air to a mean of 17°C. [62·6°F.] or more. A sudden cooling during oviposition, which usually lasts 2–3 weeks, may temporarily arrest it ; the eggs hatch more slowly, and the development of the larvae is disturbed. Infestation was most severe where the foliage of the potato was well developed and still in rapid growth when the adult beetles migrated to it for laying. Early, normal or late plants were favoured in different districts. When the period of heavy laying was protracted, the insects tended to pass from one variety to another according to their growth, so that all varieties had the same degree of infestation, but successive periods of attack. In migration the insects appeared to gather in fields bounded by natural obstacles, though they avoided shady places. The period of heavy laying began a week later in the east of the area under consideration than in the west, and more than a fortnight later in the north at altitudes over about 2,000 ft. ; in the south it began 15 days earlier than in the centre of the area, but here oviposition was abnormally protracted. The heaviest damage by the larvae generally coincided with the time of hay-making, but was slightly later than this in the west. The bad weather prevailing during the last

fortnight of May caused a reduction of oviposition in the middle and west of the area, and a temporary halt in migration in the centre and east. The second generation larvae were few, especially in the centre and the west, and this may have been due to the drought that set in on the emergence and oviposition of the first generation in July and early August.

Bruneteau (J.). **L'apion des artichauts.**—*Rev. Zool. agric.* **35** no. 3 pp. 44–45. Bordeaux, March 1936. [Recd. June 1936.]

Apion carduorum, Kby., has done much damage to globe artichokes in the Gironde in the spring; the stems are already mined by the larvae in late March, and these subsequently wither and the leaves die. Removal of the infested shoots would mean destroying entire plantations. Experiments with nicotine sprays are being made against the adults.

Hubault (E.). **Une variété géante de** *Physokermes abietis*, **Geoffr. (Hemipt. Coccidae) peu commune en France.**—*C. R. Soc. Biol.* **122** no. 21 pp. 677–678, 10 refs. Paris, June 1936.

Infestations of *Physokermes piceae*, Schr. (*abietis*, Geoffr.) in plantations of *Picea abies* are recorded from Metz and Dieuze (Moselle, France) in the spring of 1934 and from the neighbourhood of Nancy early in 1935, the females found being of abnormally large dimensions in each case. The life-history of this Coccid and previous records of its occurrence in Europe and North America are briefly quoted from the literature. The adults of *Anthribus variegatus*, Geoffr. (*varius*, F.), which was abundant on *P. piceae* in Lorraine, devour the female scales and lay their eggs beneath them, and the resulting larvae feed on the Coccid eggs. They pupate under the scale, and the adults emerge during the summer, perforating the integuments of the scale in the process. It is unknown where the adults hibernate.

Della Beffa (G.). **Relazione sull'attività del Laboratorio e R. Osservatorio di Fitopatologia di Torino nell'anno 1935.** [Report for 1935 of the Laboratory and Government Observatory of Phytopathology of Turin.]—11 pp. Turin, 1936.

In the course of the year *Aphelinus mali*, Hald., was distributed in Piedmont and elsewhere, though there was some difficulty in obtaining this Aphelinid, as both it and its host, the woolly apple aphis [*Eriosoma lanigerum*, Hsm.], had disappeared from various localities in Piedmont where it had been distributed in 1934.

Prospaltella berlesei, How., was liberated against *Aulacaspis* (*Diaspis*) *pentagona*, Targ., on mulberry, and *Rodolia* (*Novius*) *cardinalis*, Muls., was introduced from Liguria against *Icerya* [*purchasi*, Mask.], but was not satisfactory.

Lupo (V.). **Revisione delle specie di** *Aonidiella* **Berl. et Leon. del gruppo** *A. aurantii* **(Mask.).**—*Boll. Lab. Zool. Portici* **29** pp. 249–261, 4 figs. Portici, 15th June 1936.

The differential characters are given of *Aonidiella aurantii*, Mask., *A. citrina*, Coq., and *A. taxus*, Leon., with a key and the synonymy and distribution of each species.

Lühmann (M.). **Beiträge zur Chrysomelidenbiologie. 2. Beobachtungen an *Lochmaea capreae* L.** [The Biology of Chrysomelids. 2. Observations on *L. capreae*.]—*Ent. Bl.* **32** no. 3 pp. 126–128, 1 fig. Krefeld, June 1936.

The Galerucid, *Lochmaea capreae*, L., may be of some economic importance owing to the damage that it sometimes does to willows, particularly the rough-leaved species such as *Salix caprea* and *S. aurita*. In the Altmark district of Prussia, the adults that have hibernated skeletonise the leaves in early May. The females oviposit on the ground under stones or dead leaves from early June to late July. The larvae feed singly on the underside of the leaves, and the young adults appear towards the end of August. Only one annual generation has been observed.

Grempe (P. M.). **Gebäudegefährdung durch Hausbockkäfer.** [Danger to Buildings from *Hylotrupes bajulus*.]—*Ent. Rdsch.* **53** no. 33 pp. 471–474. Stuttgart, 15th July 1936.

A popular account is given of the injury done in Germany to timber in buildings by *Hylotrupes bajulus*, L., particularly churches, factories and schools.

Subklew (W.). **Grundsätzliches zur Frage der Drahtwurmbekämpfung mit Düngesalzen.** [Basic Principles relating to the Question of Wireworm Control with Manurial Salts.]—*Z. PflKrankh.* **46** no. 6 pp. 257–269, 5 pp. refs. Stuttgart, 1936.

The literature on the control of wireworms by means of various manurial salts is reviewed. The unsatisfactory position of existing investigations is due to the empirical methods employed with an inadequate knowledge of the ecology of the larvae. In an investigation on the effect of soil reaction and water content, while pH reaction was unimportant, a close connection with water content was found and the effect of salt content, which is very closely connected with it, was studied [*R.A.E.*, A **22** 248]. Potash manures can be used for direct control of *Agriotes* spp., if the alkaline chlorides, especially KCl, predominate. In the loam sand soils of central, western and south-eastern Germany the usual application of about 1,000 lb. kainit per acre would seem useful against *Agriotes obscurus*, L., if followed by a natural or artificial watering, though at the most the action is that of a repellent. No control is at present possible on moorland soil.

Macko (S.) & Pronin (J.). **Der entomologische Turm, sein Bau und seine Anwendung.** [The entomological Tower. Its construction and Use.]—16 pp., 6 figs., 2 pls. Luck, Wolyńsk. Towarz. Przyjac. Nauk., 1936. (In Polish and German.)

For statistical investigations bearing in part on the biology of forest pests, a tower has been erected in a forest near Luck, Poland, in order to capture insects by night. Built on high ground in a clearing, it consists of a platform about 10 feet square on posts about 6 ft. high. The roof, at a height of about 12 ft. from the ground, shelters a six-sided lantern, 39 inches in diameter and 32 inches high. The pressure spirit lamp has an incandescent mantle. Full details of its installation are given.

[Skalov (Yu. Yu.), Morozov (B. G.), Zelenina (I. N.) & Parievskaya (A. P.).] **Скалов (Ю. Ю.), Морозов (Б. Г.), Зеленина (И. Н.), и Париевская (А. П.). Pests and Diseases of Tobacco in the Crimea and their Control.** [*In Russian.*]—Demy 8vo, 143 pp., 73 figs., 36 refs. Simferopol, Gosizdat Kruim. ASSR, 1936. Price 3 *rub.*

This handbook opens with general information on the agricultural, chemical, biological and prophylactic methods of controlling the more important pests and diseases of tobacco in the Crimea. A section of 37 pages deals with pests (practically all of them insects) attacking tobacco seedlings and full-grown plants, notes being given on their bionomics and control, whilst a separate chapter is devoted to *Ephestia elutella*, Hb., in stored tobacco. An index is given to the Russian, Latin and local popular names of the pests, only the latter being used in the text, with a list of the chief Russian literature on the pests and diseases of tobacco. A monthly programme for measures of control is given, and a table shows the quantities of the insecticides and fungicides that should be used per acre of a tobacco plantation, with instructions for their application.

[Lyubishchev (A. A.).] **Любищев (А. А.). Principles of estimating Losses caused by Field Crop Pests and Diseases.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 12–29, 10 refs. Leningrad, 1935. [Recd. May 1936.]

This paper aims at giving a brief survey of the methods of estimating losses caused to cultivated plants by pests and diseases. The problem of the economic importance of the former comprises a series of elements, such as the degree of the infestation, the amount of the damage caused, and the resulting loss in crop and money. Analytical and statistical methods of estimating losses [*R.A.E.*, A **20** 345] may be successfully employed. Special attention should be devoted to the topographical method [**19** 348], according to which all samples taken are entered on maps with indications of the chief ecological data, such as the relief of the locality and the proximity of forests, rivers, ravines, etc. The application of this method in practice is discussed at length, and it is suggested that reliable data may be obtained if comparison is made between infested and uninfested plants that were not taken at random but selected on the basis of a character unaffected by the pest. The determination of the losses caused should comprise the quantitative estimation of the pests, the collation of data obtained with those recorded from other districts, the determination of the degree of noxiousness of the pest in different regions, and the general synthesis of the losses.

[Turaev (N. S.) & Koloukhin (L. V.).] **Тураев (Н. С.) и Колоухин (Л. В.). The Problem of calculating Losses in determining Injuriousness Indices.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 30–36. Leningrad, 1935. [Recd. May 1936.]

This paper is a discussion of a mathematical formula now being used by the Pest Record Service in the Russian Union to estimate the losses caused by pests when determining the indices of their injuriousness. A correction of the formula to obtain more accurate data is suggested.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Methods of the Investigation of the Cold Resistance of Insects.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 37–46, 5 figs., 20 refs. Leningrad, 1935. [Recd. May 1936.]

A knowledge of the cold-hardiness of various species of insect pests is of great importance in studying the geographical limits of their distribution and the laws governing their outbreaks. Recent investigations have shown that the resistance of insects to low temperatures depends on a number of factors including nutrition and the contents of bound and free water, fat and sugar [*R.A.E.*, A **23** 673, etc.]; consequently it greatly varies with the stages of development and the general condition of the insect. Detailed descriptions are, therefore, given of the necessary apparatus for, and the methods of, determining the cold resistance and the contents of water and fat in the laboratory.

[Ivanova (N. A.).] **Иванова (Н. А.). Experiments on disinsecting Plants by applying hot Water.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 47–64, 21 refs. Leningrad, 1935. (With a Summary in English.) [Recd. May 1936.]

With a view to finding simple and effective methods of treating plants against pests in nurseries and at quarantine stations, laboratory experiments were carried out in 1933 in Leningrad and Sukhum with the application of hot water against 8 species of Coccids of importance in quarantine. The literature on the hot water treatment of plants is reviewed [*R.A.E.*, A **10** 89; **11** 398; **14** 195, 287; **16** 269; **17** 175, 445], and a detailed account is given of the tests conducted by the author, the results being shown in tables. Immersing the Coccids or the infested material in hot water at 50°C. [122°F.] for 10 minutes gave complete mortality of all the species tested and their eggs. This method also proved to be the only one effective against *Aspidiotus perniciosus*, Comst. *Pseudococcus gahani*, Green, which is particularly resistant to contact and gas poisons, was more susceptible to the effect of hot water than the other species of Coccids, and it succumbed at 47°C. [116·6°F.], though some of the eggs may survive up to 48°C. [118·4°F.].

The effect of hot water treatment on plants was studied in a series of special experiments in which a number of plants and fruit trees were dipped for 10 minutes in water at 50–53°C. [122–127·4°F.]. The results show that *Citrus* and most evergreen plants, especially those with delicate foliage, cannot stand exposure to hot water at 50°C. Peaches were checked in their growth, but pears were not affected by immersion even at 53°C. Plants of which only the above ground parts were dipped were less affected than those of which the roots were also treated.

[Zhukovskiĭ (A. V.).] **Жуковский (А. В.). The History of the Propagation of the Hessian Fly in the Districts of Voronej and Kursk.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 65–78, 5 maps, 49 refs. Leningrad, 1935. (With a Summary in English.) [Recd. May 1936.]

This paper presents a survey of the occurrence of the Hessian fly [*Mayetiola destructor*, Say] in the Departments of Voronezh and Kursk

of the Black Soil Zone since 1879. Its distribution in the various districts is discussed and it is pointed out that severe outbreaks of the pest, which took place in 12 different years, occurred alternately in the northern and southern zones; recently, however, the fly has been causing more damage in the south than in the north. For the last 55 consecutive years, it has been a serious pest of cereals, especially those sown in autumn. Of the control measures recommended in the literature, sowing at the right time is the most important, the earliest dates advised being from 1st to 5th September in the north, and from 5th to 10th September in the south [*cf. R.A.E.*, A **13** 446; **16** 369]; this, however, is the optimum for years of outbreaks, whereas in normal years sowing should be effected earlier. Burning the stubble and subsequently ploughing are essential to destroy the pupae. In experiments on a small scale in 1932 with the application of chemicals against the eggs on a plot of autumn sown rye, the best results were obtained from spraying with 0·5 per cent. nicotine sulphate, which killed 73·7 per cent.

[Laduizhenskaya (L. A.).] **Ладыженская (Л. А.). The Effect of Temperature and Humidity upon the Dynamics of Corn Borer Pupation and its emergence from Pupae.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 79–86, 2 diagr. Leningrad, 1935. [Recd. May 1936.]

An account is given of field and laboratory investigations carried out in 1932–34 in Russia on the effect of meteorological conditions on the incidence of the European corn borer [*Pyrausta nubilalis*, Hb.], the field observations being conducted in the Departments of Chernigov and Kursk where the borer is a pest of primary importance on hemp and has one generation a year. Low temperature, even in the presence of a large amount of precipitation, retards the pupation of the overwintered larvae. On the other hand, insufficient rain, or complete absence of it, in April–May also considerably retards pupation and causes a high mortality among the larvae, though the temperature may be high. An average of 15°C. [59°F.] was found to be the lowest temperature at which pupation is possible; at lower temperatures the larvae do not pupate but enter a prolonged diapause. The variation in time with regard to the beginning of pupation of the larvae and the emergence of the adults amounts to 25–30 days in different years.

Experiments to determine the effect of humidity on the larvae (the temperature in all cases being maintained at 19–22°C. [66·2–71·6°F.]) showed that pupation primarily depends on the humidity of the stalks of the hemp, which are hygroscopic and readily absorb moisture from the air. The larvae are most active in moist stems, and the maximum rate of pupation, reaching 60·6–97·3 per cent., was observed when the stems were wetted. In the case of those placed in conditions of 100 and 75–80 per cent. relative humidity, the number of pupating larvae equalled 14–60 and 2·9–5 per cent. respectively; whereas at 55–60 per cent. humidity of the air, all the larvae died before pupating, as the stalks gradually dried up. Observations showed that in the outer parts of stacks of hemp that were exposed to rain, pupation started considerably earlier than inside the stacks; pupation was also retarded in stacks under cover. The optimum conditions for development are found in years with warm and damp weather at the end of spring and beginning of summer. For control it is essential to use up all the hemp straw,

which harbours the larvae, as well as to destroy all the remains of the straw and all large stalked weeds near the site before the middle of May.

[Pushin (F. E.).] **Пушин (Ф. Е.). Tractor and Automobile Sprayers in Orchard Pests and Diseases Control.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 87–93. Leningrad, 1935. (With a Summary in English.) [Recd. May 1936.]

Sprayers drawn by tractors or mounted on lorries are briefly described and their efficiency and the cost involved are discussed. It is concluded that the increase of the output is not sufficient to justify the increase of cost as compared with the horse-drawn sprayers. Tractor-drawn sprayers, as well as those mounted on lorries, are unsuitable for use in orchards where there is less than 32 ft. between the rows, nor can they be used in orchards with well cultivated loose soil, or in those having a system of irrigation ditches.

[Filatova (T. P.).] **Филатова (Т. П.). The Sugar-web Worm** *Loxostege sticticalis* **L. in Karaganda District.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 111–122, 2 graphs. Leningrad, 1935. [Recd. May 1936.]

Loxostege sticticalis, L., has been present in numbers in the Karaganda district of the Department of Akmolinsk in eastern Kazakstan since 1929, but a marked decrease in its abundance was observed in 1933 in the southern and central localities, whereas a severe outbreak occurred in the north. Observations showed that the distribution of the moths depends on the predominating direction of the wind during the summer, which carries them away at the moment when they fly up high. They tend to spend the night on high objects such as trees, etc., returning to the flowers in the morning to feed. In 1933 the adults of the overwintered generation appeared from mid-May, the peak being reached between 6th and 10th June. Oviposition started on 13th June in the insectary and on 28th–29th June in the field, becoming intense about mid-July. In the insectary, moths that lived 30–62 days matured in 18–33 days and the total number of eggs laid by a female averaged 224; those that lived 7–23 days matured in 7–16 days and laid 60 eggs each on an average. The adults of the first generation began to emerge from 5th August, the life-cycle from egg to adult being completed in 43–62 days. A large number of the larvae hibernated. Of those that became adult only a few reached maturity, and these oviposited from the end of August till the cold weather set in, but the larvae and eggs developed very slowly and were eventually killed by the frost. Thus, in the Karaganda district only the first generation is of economic importance.

The decrease in abundance in 1933 was due to the increased parasitism and disease among the larvae and pupae. Examination in the spring of 3,953 cocoons showed that 59 per cent. of the overwintering larvae and pupae were killed. The overwintered larvae were chiefly attacked by dry rot, and those of the summer generation by an infection similar to flacherie. Up to 42 per cent. of the larvae were destroyed by Hymenopterous parasites, including *Apanteles*, and 2 per cent. by Tachinids.

[Il'inskaya (L. L.).] **Ильинская (Л. Л.). On the Survival of stored Grain Mites through the Winter in the Field Conditions.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 123–125. Leningrad, 1935. [Recd. May 1936.]

In continuation of previous investigations on the viability of mites under field conditions [*R.A.E.*, A **23** 577], experiments were carried out in the northern Caucasus in autumn 1934 to determine whether the elongated mite, *Tyroglyphus putrescentiae*, Schr. [for which in the previous abstract the name *T. dimidiatus*, Herm., was suggested, no scientific name having been given in the original], and *T. farinae*, DeG., can survive the winter in the field. For this purpose, wheat artificially infested in different degrees with these mites was sown on a number of plots in the autumn, and seeds and young plants growing in samples of the soil taken from these plots were periodically examined. Analysis showed that both species of mites when introduced with the seed into the soil are able to survive the winter in the seeds. In December–February the mites chiefly occurred in seeds that had not germinated, often in those infected with fungous diseases, though they were also present in germinated seeds in which the mites fed on the remains of the endosperm. In autumn and early spring the mites are able to migrate in the soil from infested seeds to healthy ones; *T. farinae* was found in a plot in which wheat infested with *T. putrescentiae* alone had been sown, and both species occurred in the control plot and in self-sown seeds of sunflowers. Also, the fact that more mites occurred in infested plants in the spring than in the autumn indicated that individuals that had dropped directly onto the soil when the wheat was sown gradually concentrated on the seeds. During the winter the mites were in a state of torpor, but resumed activity in the spring, eggs being frequently found in April. The examination in winter and spring of samples of straw from the shocks revealed the presence of numerous mites of both species, as well as *Glycyphagus* sp., which did not occur in the plots.

[Nikol'skiĭ (V. L.).] **Никольский (В. Л.). Mites injurious to Tea Shrub in Transcaucasus.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 126–128, 3 refs. Leningrad, 1935. [Recd. May 1936.]

Brief notes are given on the geographical distribution and bionomics of the four species of mites, *Eriophyes theae*, Watt, *E. carinatus*, Green, *Paratetranychus pilosus*, C. & F., and *Tetranychus* (*P.*) *bioculatus*, W.-M., that have been found infesting tea plants in western Georgia. Of these, the first two have so far not been observed on any other cultivated plants, whereas *T. bioculatus* and *P. pilosus* are polyphagous. All four species are especially abundant in the dry, hot months on plantations on sloping ground and dry soil. Fine broad-leaved varieties of tea are preferred to the coarse ones. The attacked leaves become brown and wither, and, in the case of infestation by *E. carinatus* and *T. bioculatus*, they fall off. All stages of the mites occur simultaneously, and they are easily carried to uninfested plantations on the clothes of labourers.

Control measures should include destruction of weeds, careful examination of all planting material, and dusting the infested bushes with sulphur dust at the rate of 9–13 lb. to the acre, or spraying with an emulsion of 2 gals. kerosene, 1 lb. soft soap and 4 gals. boiling water diluted in cold water at the rate of 1 : 10. To destroy the eggs,

spraying or dusting should be repeated, and in order not to affect the flavour of the tea the bushes should be treated not less than 10–12 days before picking.

[Pospelova (V.).] **Поспелова (В.). Products and By-products of the Coke and Benzol Industry in Pest Control.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 129–131. Leningrad, 1935. [Recd. May 1936.]

An account is given of laboratory and field experiments in the environs of Tomsk in western Siberia in 1934 on the possibility of using against insect pests the by-products obtainable from the coke-benzol industry. Fairly stable semi-solid stock emulsions were obtained from solvent naphtha and anthracene and naphthalene oils, the proportion used being 75 per cent. oil, 15 per cent. soft soap and 10 per cent. water [*cf. R.A.E.*, A **20** 201]. The jellies served to prepare emulsions at concentrations of 0·5–2 per cent., the effectiveness of which was tested in the laboratory by dipping into them counted numbers of the cabbage aphis [*Brevicoryne brassicae*, L.] and the pea aphis [*Macrosiphum onobrychis*, Boy.], the results being estimated in 1, 3 and 24 hours. A satisfactory rate of mortality was obtained from all the oil emulsions, used at a 1 per cent. concentration, 75·6–93 per cent. of the Aphids being killed. When applied in the field to infested cabbages as sprays, 100 per cent. mortality of *B. brassicae* was produced by 1 and 1·5 per cent. concentrations of emulsions of anthracene oil and solvent naphtha respectively, and 95·8 per cent. mortality by a 2 per cent. concentration of naphthalene oil emulsion. Treating infested cabbage with dusts prepared from these oils mixed with road dust or ashes and used at 5 per cent. concentration, killed 89·3–90·1 per cent. of *B. brassicae*, but in the case of pea plants, the Aphids migrated from the dusted parts, probably owing to the strong odour. Dusting with crude naphthalene (1 part to 4 or 9 of the carrier) or with crude anthracene (1 part to 9 of the carrier), killed 99·6, 96·8 and 81·9 per cent. of the cabbage aphis respectively.

All the emulsions and dusts tested, with the exception of those in which naphthalene oil was used, severely scorched the plants. Special attention should, therefore, be devoted to further tests with naphthalene oil and to finding suitable emulsifiers for the other oils that would prevent scorching.

Laboratory and field tests of the oil emulsions against the larvae of the rape sawfly [*Athalia rosae*, L.] gave unsatisfactory results, as up to 56 per cent. of the larvae revived.

[Ivanova (N.) & Paĭkin (D.).] **Иванова (Н.) и Пайкин (Д.). The Quarantine Fumigation of Citrus Nursery Stock with Hydrocyanic Acid Gas.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 132–133. Leningrad, 1935. [Recd. May 1936.]

Experiments were carried out in autumn 1932 in Sukhum to test the efficiency of fumigation of seedling *Citrus* trees with hydrocyanic acid gas against various Coccids. In an airtight fumigation chamber, a dosage of 3–4 oz. of HCN per 1,000 cu. ft. at a temperature of 20–25°C. [68–77°F.] and an exposure of 40–45 minutes completely killed all stages of *Chrysomphalus dictyospermi*, Morg., *Pulvinaria aurantii*, Ckll., *Icerya purchasi*, Mask., and all eggs of *Pseudococcus*

gahani, Green, but only 96–98 per cent. of the adults of the last-named. Complete mortality of the latter only occurred with fumigation for 75 minutes and an increase of the concentration up to 5–6 oz. per 1,000 cu. ft. at 20–25°C. and 70–80 per cent. relative humidity. At an exposure of 45 minutes, complete control of all stages of *P. gahani* was obtained with 7–8 oz. of HCN per 1,000 cu. ft., but this dosage caused severe scorching in the seedlings. In all cases of fumigation, even with 2–3 oz. per 1,000 cu. ft. for 45 and 75 minutes, injury to the green parts of the plants was manifested on the 2nd–3rd day after the treatment, brown spots appearing at the edges of the leaves ; in instances of more severe scorching, the foliage and young shoots, and sometimes the whole plant, died. The damage increased if plants were fumigated when wet, or if they were exposed to the sun after the treatment. On the other hand, fumigating dry plants and placing them in the dark after treatment had a beneficial effect on the general condition of the seedlings.

The Henbane (*Hyoscyamus niger* **and** *H. agrostitis*) **as Insecticide.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 134–135. Leningrad, 1935. [Recd. May 1936.]

Notes are given on the poisonous properties of winter henbane, *Hyoscyamus niger*, which chiefly grows along roads, ditches and among weeds, and summer henbane *H. agrostitis*, which mainly occurs in the fields of millet, poppy, and certain other cultivated crops. In laboratory and field experiments in July and August in the environs of Astrakhan, a concentrated infusion made of a mixture of dry chopped inflorescences, leaves, stems and roots of henbane picked in May, taken in the proportion of 1 lb. to 1 gal. water, rapidly killed the Aphids on cabbage and watermelons, as well as other Rhynchota. The effectiveness of the infusion was not decreased by dilution to a half or quarter of the concentration. The strongest and most rapid action was obtained when the infusion was prepared from fresh winter henbane that had sprouted and developed rosettes in the autumn, the roots being particularly effective. The sprayed plants were not scorched. Further investigations on the use of henbane against insect pests are recommended, and brief instructions are given for the picking and drying of the plants.

[Sevast'yanov (I. A.).] **Севастьянов (I. A.). Extracts from Reports of the Central Asiatic Institute of Plant Protection (SAIZRA) for the Year 1934.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 4 pp. 136–140. Leningrad, 1935. [Recd. May 1936.]

Experiments on the control of the codling moth [*Cydia pomonella*, L.] with calcium arsenate showed that in dusting there exists a direct relation between the dosage of the poison and the rate of mortality, a kill of 93·3 per cent. being sometimes obtained. Spraying with 0·1–0·4 per cent. concentrations, with or without the addition of 1 per cent. extract of lucerne and sesame, did not ensure a complete mortality of *C. pomonella*. The percentage of mortality decreased after rain markedly more in the case of dusted than sprayed fruit.

Investigations on flour mites showed that they are widely distributed in Central Asia, though the species concerned have not been identified. In summer they are not killed by the heat but penetrate into the deep

layers of the stored grain. Cotton seeds are severely infested, heaps of cotton husk and other débris used for fuel probably acting as sources of infestation. The mites may be killed by exposing the infested grain in layers 2 in. thick to the sun in September. Moreover, predators rapidly develop in dry grain and outnumber the mites.

Laboratory tests in which a counted number of the adults and larvae of the grain weevil [*Calandra granaria*, L.] and the flour beetle [*Tribolium confusum*, Duv.] were dipped for a moment into a tank-mix emulsion of solar oil (1–5 per cent.), household soap (0·1–0·2 per cent.) and polychlorides, demonstrated that this emulsion may be effectively used in empty stores infested with grain pests.

The value of hydrogen sulphide in the control of pests of dried fruit was tested on *C. granaria* and *T. confusum*, the adults of *Oryzaephilus* (*Silvanus*) *surinamensis*, L., and the larvae of *Plodia* and *Ephestia*. Complete mortality of the first two species was obtained at a dosage of 10 oz. to 1,000 cu. ft. and exposures of 12 and 24 hours, whereas fumigation for 6 hours only killed 86–98 per cent. A dosage of 9 oz. to 1,000 cu. ft. killed all the larvae of *Plodia* and *Ephestia* in 6 hours and 73–80 per cent. of *O. surinamensis*; all the beetles, however, were killed in 6 hours when the dosage was increased to 15 oz. At an exposure of 4 hours all the larvae and beetles were killed by a concentration of 18 oz. to 1,000 cu. ft. the same results being obtained with 12 oz. and an exposure of 6 hours in November-December. An analysis of the fumigated dried fruit showed that hydrogen sulphide had no deleterious effect on its quality.

In field tests of various preparations of sulphur against the red spider [*Tetranychus*] on cotton, the best results were obtained from the application of ground sulphur, irrespective of whether it was mixed with talc, road dust, or lime, 2 parts sulphur being taken to 1 part of the carrier; applied at the rate of 36 lb. to the acre, the dust killed 70–87 per cent. of the mites according to estimation 9 days after the treatment.

Spraying or dusting apricot trees with calcium arsenate proved to be dangerous under conditions in Ferghana, as frequent rains occurring early in summer increase the resorbent action of the poison, which penetrates into the stems through the leaves and cracks in the bark, and causes heavy shedding of the foliage and fruit. In the laboratory, the addition of lime neutralised the scorching properties of the arsenate. Lead arsenate was practically harmless to the trees.

Erratum.—*Plant Prot.* 1935 fasc. 4 p. 168. Leningrad, 1935. [Recd. May 1936.]

Attention is called to the fact that the beetle recorded in a recent paper as a pest of soy beans in the Russian Far East [*R.A.E.*, A **23** 573] was erroneously identified as *Pagria signata*, Motsch. The correct identification is the Galerucid, *Monolepta nigrobilineata*, Motsch.

Dobrovol'skiĭ (B. V.).] **Добровольский (Б. В.). On the Regularities of Propagation and Dying out of *Loxostege sticticalis* L.** [*In Russian.*] —*Plant Prot.* 1935 fasc. 5 pp. 67–74, 5 maps. Leningrad, 1935. (With a Summary in English). [Recd. May 1936.]

With a view to collecting data for the study of the laws governing the incidence of *Loxostege sticticalis*, L., an account is given of the occurrence

of this moth in the Departments of North Caucasus and of the Azov and Black Seas in 1933, when a marked decrease in its numbers took place. Examination of the soil in the spring showed that of the larvae that entered hibernation in the preceding autumn, 40–45 per cent. had been destroyed by predators, parasites and especially fungous and bacterial diseases. Moreover, large numbers of the cocoons were killed by the reploughing of the infested fields in autumn 1932 and spring 1933. There were three generations, but owing to the low average temperature in April and May, which did not exceed 12–15°C. [53·6–59°F.], the flight of the adults of the overwintered generation and the development of their ovaries were retarded, only 35 per cent. of the females possessing mature eggs in the first half of June. Though their numbers increased to 70 per cent. later in the month when the temperature rose to an average of 17–18°C. [62·6–64°F.], this coincided with the end of the flight period. About 50 per cent. of the larvae of the first generation in cocoons were killed by diseases, predators and Tachinids. Most of the resulting young females were sterile, probably owing to the hot and dry weather in July, when the temperature reached 26–27°C. [78·8–80·6°F.] and the relative humidity dropped to 35–55 per cent. Moths with developed ovaries only appeared at the end of the flight period when the temperature decreased to 18–22°C. [64·4–71·6°F.]. The numbers of the second generation larvae were, therefore, negligible, and of these up to 80 per cent. were parasitised by Tachinids in some districts. Though about 30–70 per cent. of the moths of the second generation emerged with developed ovaries, a sudden spell of cold weather in September caused sterility in the females and curtailed the period of the flight. There were but very few larvae of the third generation, and of these up to 68 per cent. were attacked by Tachinids. An increase in the numbers of the local moths by immigrants only occurred in the northern districts of the area at the end of May and again about mid-June, when moths were brought in by winds from the east and the Ukraine respectively. The immigrants that appeared in July were sterile.

[Dmitriev (G. V.).] **Дмитриев (Г. В.). Results obtained in studying *Psylliodes attenuata* Koch, under Conditions prevailing in the Right Bank Area of the Kuybyshev District.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 5 pp. 91–106, 2 graphs, 1 ref. Leningrad, 1935. (With a Summary in English.) [Recd. May 1936.]

The Halticid, *Psylliodes attenuata*, Koch, is of particular importance as a pest of hemp in this district, situated on the right bank of the Volga, where this crop is extensively cultivated. Its bionomics are similar to those already noticed from the Black Soil zone [*R.A.E.*, A **19** 305]. In the spring the flea-beetles concentrate on hops (*Humulus lupulus*), nettles (*Urtica urens*), hemp (*Cannabis sativa*), and *Lappa tomentosa* ; in cold weather they make their way into the upper layers of soil, and in the case of sprouting hemp attack the underground part of the stem near the root, causing injury that invariably kills the plants. Experiments showed that the adults only thrive on the above four species of plants. In July–August the young flea-beetles feed on the leaves, and in hemp they also destroy the inflorescences, the ovaries and the contents of the seeds, and make deep wounds in the upper portion of the main stem. These beetles do not migrate far and only occur within a radius of rather more than

a mile from infested hemp fields. Hibernation of the adults chiefly takes place in the soil in hemp fields up to a depth of 6 ins., but also inside the stems of the stubble or in stalks of hemp damaged by *Pyrausta nubilalis*, Hb. The adults are very cold-hardy and practically all of those that hibernated in the open inside the stems of hemp survived temperatures as low as —25°C. [—13°F.]. Though spring flood water apparently does not affect the hibernating adults, excessive humidity is detrimental to the immature stages. The first overwintered adults appeared about mid-April, and the first eggs were found on 10th May. Supplementary feeding is essential for oviposition. In 1934 there were three peaks in the flight of the adults—in late May, early July and late August.

About 80 per cent. of the females in 1934 were parasitised by the Braconids, *Perilitus bicolor*, Wesm., and *P. labilis*, Ruthe, of which the former was predominant. It has two generations a year, hibernation occurring in the adult stage. The first flight takes place in June, and the second in August. The larva develops in the adult flea-beetle (which dies 1–2 hours after the parasite abandons it) and pupates in the upper layer of the soil. *P. labilis* hibernates as a larva or pupa, and the adults were observed on the wing in the second half of May. The number of generations has not been ascertained. The larvae pupate on the surface of the soil among vegetable matter, and the pupal stage lasts 14–17 days.

Control measures include burning the débris and vegetable remains in hemp fields in the spring and immediately after harvest; spraying or dusting nettles with insecticides; thorough autumn ploughing of the fields; and good cultivation of the hemp, with sufficient manuring to raise the power of resistance of the plants. Early sowing may not safeguard hemp from infestation, as the severity of the latter depends in each case on meteorological factors, the situation of the field and the abundance of the overwintering flea-beetles. Dense sowing was also found not to have any effect on the severity of the damage caused.

In preliminary spraying and dusting experiments with a number of insecticides in the field and on plants in pots, the most effective insecticides were various fluorine preparations and calcium arsenate.

[Dobrovol'skiĭ (B. V.).] **Добровольский (Б. В.). Preliminary Data on the Caoutchouc Plant Injuries in North Caucasus.** [*In Russian.*] —*Plant Prot.* 1935 fasc. 5 pp. 111–116, 1 ref. Leningrad, 1935. [Recd. May 1936.]

Investigations in 1931 showed that polyphagous insects were chiefly responsible for the destruction of a great number of rubber-producing plants in North Caucasus, where their cultivation has only recently been started. *Scorzonera tau-saghiz*, which develops slowly and in the first year of its growth has tender juicy roots, appeared to be especially susceptible to the attacks of soil pests [*cf. R.A.E.*, A **24** 19]; of the other species, *Parthenium argentatum* was also severely damaged, whereas *Asclepias cornuti*, *Chondrilla ambigua*, *C. pauciflora*, and *Apocynum venetum*, all of which grow rapidly and have coarse leaves and roots, were considerably less infested.

Brief notes are given on 23 species of injurious insects found, the chief of these being: *Gryllotalpa gryllotalpa*, L., which attacked the

root-collar in *Scorzonera* and *Chondrilla*; *Aphis cuonymi*, F., which was common on the terminal leaves of *Asclepias*; the larvae of various Elaterids, Tenebrionids and Cistelids, which were especially harmful to *Scorzonera* and *P. argentatum*; those of *Anisoplia segetum*, Hbst., and *Pentodon idiota*, Hbst., which attacked *Scorzonera*; the larvae of *Euxoa segetum*, Schiff., which attacked the root-collar and the foliage of *Scorzonera* and *Chondrilla*; and those of *Acronicta rumicis*, L., which were common on the leaves of *Chondrilla*.

Stored *Scorzonera* seeds were found to be infested by the larvae of *Plodia interpunctella*, Hb., and to harbour the adults of *Ptinus fur*, L.

[Blagovo (M. K.).] **Благово (М. К.). Crops cultivated in Stubble-fields and Pests.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 5 pp. 130–131. Leningrad, 1935. [Recd. May 1936.]

With a view to ascertaining whether insect pests would prevent the cultivation for the second time in the same season of fields immediately after the harvest of the first crops, experiments were carried out in the second half of July 1934 in the Department of Kuĭbuishev (Samara), in which various crops were sown in separate plots in a field that had previously been under winter rye. Examination of germinating wheat soon after sowing showed that it was severely infested with the barley aphis, *Brachycolus noxius*, Mordv., and the larvae of *Oscinella frit*, L., both species having migrated from the summer wheat that was then being harvested. By September most of the newly sown wheat was destroyed by these two pests. Barley and oats were infested with the larvae of *O. frit*, though not so severely as wheat, and the leaves of vetch, soy beans, sunflowers, potatoes, maize and *Sorghum* were slightly attacked by Acridids.

[Shchegolev (I. N.).] **Щеголев (И. Н.). *Anarsia lineatella* Zell. as a Pest of Plum Trees and *Diospyros kaki* L. on the Black Sea Coast of Caucasus.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 5 pp. 131–132. Leningrad, 1935. [Recd. May 1936.]

As under the conditions of the Black Sea coastal zone the peach twig borer, *Anarsia lineatella*, Zell., may become an important pest of one-year old plum trees and of persimmon (*Diospyros kaki*), brief notes are given on its bionomics as observed in summer 1932 in Sochi in Transcaucasia. Eggs were laid in the sheaths of the leaves and sometimes on the bark of the shoots, especially in the case of persimmon. The young larvae do not mine in the bark, but penetrate into the shoot and make a horizontal tunnel towards the heart of the shoot where they bore a short mine towards the base and a longer one towards the tip. The gallery is carefully cleaned by the larva, all the frass and excreta being removed outside; the exuding resin mixed with the web of the larva and the excreta often forms a crust near the entrance hole. Pupation takes place about the middle of July; in the insectary, the adults of the summer generation appeared at the beginning of August. The period of flight and of oviposition is usually very protracted. In young plum trees, the infestation causes the premature formation of the crown (a whole year earlier), which is weak and deformed. In persimmon, however, which is a much more vigorous tree, the damage done is less marked.

[Durnovo (Z. P.).] **Дурново (З. П.) Tortricids injurious to Italian Hemp and *Hibiscus*.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 5 pp. 132-134. Leningrad, 1935. [Recd. May 1936.]

Observations in the summers of 1933 and 1934 in the west of Northern Caucasus showed that hemp and *Hibiscus* [*cannabinus*] were infested to a considerable extent by Tortricids, the larvae of *Tortrix* (*Cacoecia*) *strigana*, Hb., and *Phiedone gerningana*, Schiff., occurring on hemp, those of *Eulia politana*, Hw., and *T.* (*Pandemis*) *heparana*, Schiff. on *Hibiscus*, and the larvae of *T.* (*C.*) *lafauryana*, Rag., on both crops. A list is also given of various weeds on which these species were found. They each had three generations a year, hibernation apparently occurring in the pupal stage. The adults of *T. lafauryana* were on the wing from 21st April in 1934, and first instar larvae appeared on sprouting hemp on 11th May in 1933 and 30th April in 1934. The larvae of the first generation pupated from the end of May, and the pupal stage lasted 10 days. The resulting adults were on the wing from 10th June, and the larvae of the second generation pupated in July ; the moths occurred at the end of July and in August. The most important damage to hemp was caused in the spring by the larvae injuring the point of growth, 14 per cent. of the plants being thus affected ; the damaged plants were either killed or excessive branching was produced, which caused a deterioration in the quality of the fibre. Up to 28 per cent. of the plants had the tips webbed together, and this retarded development and often caused deformation. In the summer, the inflorescences became covered with the larval webs, which considerably reduced the yield of seed.

Parasites reared in the laboratory included : *Macrocentrus abdominalis*, F., and *Glypta flavolineata*, Grav., from the larvae of *T. lafauryana* ; *Glypta* sp. from those of *T. strigana* ; and *Pimpla alternans*, Grav., and *Nemorilla* (*Thiella*) *floralis*, Fall., from pupae of *E. politana*.

[Dmitriev (G. V.).] **Дмитриев (Г. В.). Insects injurious to Hemp on the Right Bank of Volga in Kujbyshev District.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 5 pp. 134–136. Leningrad, 1935. [Recd. May 1936.]

This is an annotated list of 33 species of injurious insects observed in 1932–34 on cultivated hemp in this district. The economic importance of each pest is indicated, with brief notes on its biology.

[Morozov (S. F.).] **Морозов (С. Ф.). The Penetration of Contact Insecticides. Part I. Methods of Investigation and general Properties of the Cuticle with Regard to its Permeability.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 6 pp. 38–58, 28 refs. Leningrad, 1935. (With a Summary in English.) [Recd. July 1936.]

In laboratory investigations in Leningrad, the manner in which various poisonous substances penetrate the cuticle of insect larvae was studied, the insects used being the larvae of *Loxostege sticticalis*, L., *Pieris rapae*, L., *P. brassicae*, L., *Pyrausta nubilalis*, Hb., and the Syrphid, *Eristalis arbustorum*, L. The substances tested included acetic acid and hydrochloric acid (both with a pH of 2·25), and ammonia and sodium hydroxide (both having a pH of 10·8). The technique for removing the cuticle from the larvae and gauging the penetration of the substances through it is described, and the observations tabulated. It was found that the chitinous cuticle possesses a selective permeability

with regard to acids and alkalis of different degrees of dissociation, those weakly dissociated, such as acetic acid and ammonia, penetrating more quickly than strongly dissociated ones, such as hydrochloric acid or sodium hydroxide. When, however, the cuticle was boiled for 30 minutes in a 20 per cent. solution of sodium hydroxide, the substances tested penetrated it with equal and markedly increased rapidity. On the other hand, boiling it for the same period of time in distilled water did not affect its selective property, and though it became much more permeable, the substances penetrated it at varying degrees of rapidity. These phenomena are due to the complete or partial destruction by the solution of the epicuticular layer, which is unaffected by the distilled water. The permeability of the cuticle decreases as the larvae mature, a microscopic examination of the chitin showing that the epicuticular layer is much less developed in the younger instars. Whilst the cuticle varies in permeability in different species of larvae, this depends less on the thickness of the chitin as a whole than on the properties of the epicuticular layer. Further, some parts of the skin, especially on the ventral surface, were more susceptible to penetration than others. Mature larvae of *E. arbustorum* were particularly resistant, their cuticle being 8–10 times less penetrable than that of the Lepidopterous larvae for the same substances and at the same concentrations ; this is probably because the epicuticular layer of the former species is considerably thicker and the larvae live in polluted media.

Vladimirskaya (L. I.).] **Владимирская (Л. И.). Studies on Outbreaks of *Loxostege sticticalis*, L., in Relation to meteorological Conditions.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 6 pp. 59–74, 8 figs., 1 ref. Leningrad, 1935. (With a Summary in English.) [Recd. July 1936.]

On the basis of statistical data obtained from a number of meteorological stations, an analysis is made of the weather conditions that have accompanied severe outbreaks of the meadow moth, *Loxostege sticticalis*, L., in various parts of European Russia since 1855 [*cf. R.A.E.*, A **19** 76]. It is concluded that they occur over large areas in years with an abnormally high temperature from March to June, provided that the preceding summer was wet with rainfall above the normal during June, July and August [*cf.* **22** 373]. On the other hand, the numbers of this moth often decrease markedly when these conditions are not fulfilled. Outbreaks are also greatly influenced by such biological and physiological factors as migrations, sterility of the females and the diapause of mature larvae if rain is lacking or temperature falling at the time of pupation. Factors governing local outbreaks over small detached territories cannot be detected by studying the prevailing meteorological conditions, as each depends on the complex of a number of local conditions.

[Pospelova (V.).] **Поспелова (В.). The Cutworm *Rhyacia fennica* Tausch. as a Pest of Vegetable Crops.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 6 pp. 140–142, 2 refs. Leningrad, 1935. [Recd. July 1936.]

The Noctuid, *Agrotis* (*Rhyacia*) *fennica*, Tausch., which has not previously been recorded as a pest of any importance in the Russian Union, has caused considerable damage to vegetables, chiefly cabbage, in the environs of Tomsk (western Siberia) since 1932. The mature

larva is described to facilitate its distinction from that of *Euxoa* (*Agrotis*) *tritici*, L., and *E.* (*A.*) *islandica*, Stgr., both of which are common on vegetables in that district from about mid-June; those of *A. fennica* appear earlier, from about the end of May. Mature larvae are found in the spring, indicating that this moth hibernates in the larval stage. In 1932–35 mass pupation usually occurred about 20th June, and the adults were on the wing in July-August. In the insectary, the larvae pupated in the soil in earthen cells, and as in the field no pupae were found near the damaged plants, it is supposed that they migrate to fallow land, or make their way into deeper layers of the soil. They chiefly fed on the edges of cabbage leaves, but were also found on seedlings of cucumbers, and in 1933 damaged rape grown for seed, of which they considerably reduced the yield, 1–7 larvae being found under each plant.

Infestation only occurred in fields that had been cultivated for not longer than 1–2 years. Preliminary experiments on a small scale with poisoned baits of wheat bran or horse dung, or a mixture of the latter with fine flour (2 : 1), with the addition of 5 or 3 per cent. solutions of sodium arsenite, sodium fluoride, or sodium fluosilicate, showed great promise in control.

[Vasil'ev (I.).] **Васильев (И.). The Insect Pests of the *Phaseolus* in Abkhasia.** [*In Russian.*]—*Plant Prot.* 1935 fasc. 6 pp. 142–143, 2 refs. Leningrad, 1935. [Recd. July 1936.]

Observations on pests of different kinds of beans (*Phaseolus*) near Sukhum in Transcaucasia showed that besides the Bruchid, *Bruchus* (*Acanthoscelides*) *obtectus*, Say [*R.A.E.*, A **23** 570], they were attacked in 1933 by a number of other insects, especially the green bug, *Nezara viridula*, L., the bean aphis, *Aphis fabae*, Scop., and a red spider, *Tetranychus telarius*, L. *N. viridula* was active from July till late October, infesting the ovaries and pods of the beans, retarding their development, and causing some to turn yellow and drop; about 30 per cent. of the pods were thus damaged. The Aphid was abundant on the stems, inflorescences and young pods of late varieties. The red spider attacked the leaves in September, usually migrating to them from elder (*Sambucus* sp.). Less important pests were: *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.) and *Lampides baetica*, L., both of which attacked unripe pods, the former destroying up to 10 per cent. of the still soft seeds; *Diacrisia lubricipeda*, L. (*Spilosoma menthastri*, Esp.), *Laphygma exigua*, Hb., *Plusia* (*Phytometra*) *gamma*, L., *Eulia politana*, Hw., and *Anacridium aegyptium*, L., all of which damaged the leaves; the Capsids, *Adelphocoris lineolatus*, Goeze, and *Lygus pratensis*, L., which infested the inflorescences, ovaries and green pods; and the Jassid, *Cicadella viridis*, L.

Under the local conditions none of the pests mentioned attacks the beans before July, and the early sowing of rapidly maturing varieties is therefore recommended.

Mamikonyan (V. V.).] **Мамиконян (В. В.). Studies of the Injuriousness, economic Importance and some Biology of the Tea Aphid and Mite. Control Measures against the Mite.** [*In Russian.*]—Abstract in *Plant Prot.* 1935 fasc. 6 pp. 143–144. Leningrad, 1935. [Recd. July 1936.]

Field observations in 1934 on the tea aphis [*Toxoptera aurantii*, Boy.] in Transcaucasia showed that the wingless adults are present

throughout the year. Propagation takes place from late April till October, when it decreases with the falling temperature, finally ceasing in winter. In the warmest months, increase is checked by Syrphid larvae and Braconids. Alate individuals occur in the summer and are chiefly distributed by the wind. On the tea bushes the Aphids move about by crawling. When deprived of food, they were able to crawl a distance of 16–18 ft. Infested shoots are less resistant to various unfavourable factors and the tips often die.

The only mite occurring on tea in the Caucasus is *Eriophyes carinatus*, Green. It chiefly damages old leaves of the southern varieties, attacking the upper surface, which becomes purple and as if covered with a whitish-grey dust, only the period of rest being spent on the lower surface of the leaves [*cf. R.A.E.*, A **19** 238]. When numerous, the mites also occur on the shoots and the bud-scales. Dry weather is most favourable to them. Dusting with sulphur killed in 30 minutes all the mites on the upper surface of the leaves and 25–30 per cent. of those on the lower surface, and in the laboratory, 100 per cent. kill was obtained on both surfaces. Spraying with a preparation called " Emulsoil " used in a concentration of 1 per cent. killed all stages without scorching the leaves, whereas higher concentrations severely injured them.

[Trapaidze (K. G.).] **Трапаидзе (К. Г.). A Study of the Biology of the small brown Beetle.** [*In Russian.*]—Abstract in *Plant Prot.* 1935 fasc. 6 p. 144. Leningrad, 1935. [Recd. July 1936.]

On the southern part of the Black Sea coast of Georgia (Adzharistan) persimmon, *Citrus*, egg-plants, pepper and tea are attacked by a beetle, possibly *Aserica castanea*, Arr. [*cf. R.A.E.*, A **22** 172] or *Maladera punctatissima*, Fald., which is widely distributed. The adults begin to emerge in June, the flight continuing throughout July and August. The beetles live in the soil at a depth of about 2 ins. near the root collar of the food-plants, and about 20 per cent. appear above ground at dusk, flying about till midnight and feeding on the young leaves. The beetles spend 5 days in the pupal chamber before emerging, and after that live for 12–75 days ; they begin to feed 3 days after emergence, and are able to resist starvation for 10–15 days. The female lays eggs in the soil at a depth of $\frac{1}{2}$–2 ins. singly or in batches of up to 20, and the egg-stage lasts 6–9 days. The eggs do not develop in excessively dry or damp soil, and the larvae only thrive in moderately damp soil, feeding on the roots and humus at a depth of 1–6 ins. Winter is spent in the larval stage, and pupation begins in the following May, the maximum number of pupae being found in mid-July. The pupal stage lasts 13–17 days. No parasites were found.

[Sokolov (A.).] **Соколов (А.). Report on the Work on Grain Mites conducted by the Ivanovsk Station of Plant Protection in 1934.** [*In Russian.*]—Abstract in *Plant Prot.* 1935 fasc. 6 pp. 146–147. Leningrad, 1935. [Recd. July 1936.]

A survey of stored grain in the winter of 1934 in the Ivanovsk Region (central Russia) revealed a high degree of infestation by the flour

mite [*Tyroglyphus farinae*, DeG.], and to a less extent by the elongate and the hairy mites [*Tyroglyphus* (?) *putrescentiae*, Schr., and *Glycyphagus cadaverum*, Schr., respectively]; predatory Gamasid mites were also present. At 20–24°C. [68–75·2°F.], *G. cadaverum* predominated if the grain was very moist, whereas *T. farinae* and *T. dimidiatus* were prevalent if the moisture content was 16–20 per cent. A further decrease in humidity resulted in a reduction in numbers of all three species, whereas the Gamasids markedly increased. At 17°C. [62·6°F.], the latter only occurred in the surface layer of the grain, the elongate mite somewhat deeper and the flour mite deeper still. The Gamasids cannot, therefore, effectively control the grain mites, although they prey actively on them. Experiments have shown that the optimum temperature for the development of the mites occurs between 18 and 25°C. [64·4–77°F.], but motion, pairing, oviposition and hatching of the larvae are possible even at 2°C. [35·6°F.]. When deprived of grain for 24 hours at low temperatures, all stages of all species died at −29°C. [−20·2°F.]; at from −26 to −15°C. [−14·8 to −5°F.] some of the Gamasids, as well as the hypopial forms of the grain mites and the eggs, survived. If, however, the mites were protected in the grain, the predators and some of the flour mites survived even if the temperature was as low as −30°C. [−22°F.] for 24 hours. The hypopi only appeared in numbers if the grain was mouldy or very dirty [*cf.* **20** 618]. The adults of *G. cadaverum* moved on an even surface three times as quickly as those of the flour mites. In the case of rye and wheat the mites fed on the débris, as well as on whole grains, eating out a pit in the germ and then penetrating inside the grain; in oats and flax seed the germ was, however, not touched.

Grain, especially rye and wheat, was effectively freed from the mites by passing it through cleaning machines and separators. Dusting it with naphthalene or paradichlorobenzene at the rate of 1 part by weight to 1,000 parts of the grain, killed 100 per cent. of the mites, only half this quantity being required for scaleless grain. In grain with 17–18 per cent. humidity, germination did not decrease for 3 months, and if it was aired, no trace of smell was left in 7–10 days. In laboratory experiments in which mites isolated from the grain were treated with various liquid poisons, 100 per cent. mortality in 12-15 hours was obtained from the application of a number of preparations, including the standard lime-kerosene emulsion, a 5–10 per cent. solution of sulphuric acid, a 1 : 70 solution of formalin, and 10 per cent. acetaldehyde. Spraying infested grain with a 20–25 per cent. solution of chloride of lime did not kill the mites even after an exposure of 24 hours. Of the fumigants tested, the best results were obtained in the case of rye and oats from the application of a 3–6 per cent. concentration of hydrogen sulphide for 24 hours, 100 per cent. mortality of all stages being obtained and the germination not being affected. Benzene, used at the rate of 2 fl. oz. to 10 cu. ft. at a temperature of 23°C. [73·4°F.] killed in 24 hours mites isolated from the grain, and in 36 hours those inside the grain at a depth of about 5 ft. Experiments with the control of mites by heat showed that in grain with a moisture content of 19 per cent. they are killed in 95 minutes at 40–45°C. [104–113°F.], in 45–60 minutes at 60°C. [140°F.] and in 2½ minutes at 145°C. [293°F.], germination being in no case impaired. At 180°C. [356°F.] the mites died in 1 minute, but the germination of rye and wheat decreased by 10–13 per cent., though their nutritive qualities were not affected.

LEPESHKIN (S. N.). **On the Extermination of** *Calliptamus italicus* **L. in the Merv Oasis.** [*In Russian.*]—*Acrididae of Central Asia*, pp. 9–81, 8 figs. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

Of the three species of *Calliptamus* occurring in the Merv Oasis [Transcaspia], *C. turanicus*, Tarb., is restricted in its distribution [*cf.* next paper], and *C. siculus*, Burm., has not been definitely recorded to damage cotton, but *C. italicus*, L., is widely spread throughout the oasis and is an important cotton pest. It is most numerous in the central and southern parts of the oasis, the area of injury almost coinciding with that of irrigated cultivation.

For oviposition, the females require non-saline or only slightly saline, fairly compact, absolutely dry warm soils, well exposed to the sun. The ground must be partially covered by low, creeping plants, particularly *Cynodon dactylon*, among the roots of which the egg-pods are laid. Such habitats occur along field boundaries, roadsides, irrigation canal embankments and dry beds of streams, in fallow and waste lands among cultivated fields, and particularly in abandoned lucerne fields, in which the greater part of the vegetation cover consists of various weeds. It is in these that the maximum average density of oviposition, as determined by soil samples, is found. The ecological conditions and vegetation in all such habitats are discussed in great detail.

Observations on diurnal and seasonal migrations and on habitat preferences of different instars were made by means of counting specimens caught in a net laid on the ground, or by sweeping, carried out in all the characteristic habitats; a special study of the food-plants was also undertaken.

Hatching generally ends by early June, and the first adults appear about the same time. In the middle of June the bands are made up of the 3rd, 4th and 5th instars, as well as of young adults. The movements of bands are not uniform, each hopper behaving independently of the others, the irregularity being due to differential responses to external stimuli by different instars. The general direction of movement is determined by the instar that forms the majority. The density of bands increases from hatching until the last moult, after which the aggregations break up.

First instar hoppers tend to move away from the tufts of grass among which they hatch to the more exposed, sunny spots; the 2nd and 3rd instars move into the thickets of *Atriplex laciniata*, *Zygophyllum fabago* and cruciferous weeds growing on dry fallow and waste lands and canal embankments; the 4th and 5th instars and the adults prefer dense growths of such plants as *Alhagi camelorum* and *Glycyrrhiza glabra*, which frequently form thickets on dry hillocks and fields with saline soil and on the margins of cultivated fields, from which *Calliptamus* overflows on to the cotton plants. After the maturation of eggs, the females migrate back to the areas with patchy creeping vegetation, for oviposition. When the different types of vegetation required by different instars occur on the plot on which hatching took place, *Calliptamus* will not migrate at all; in general the radius of migrations during the life-time does not exceed 100–350 yards from the place of hatching, and the eggs are deposited in the nearest suitable place. The maximum density of hoppers and adults is found on abandoned lucerne fields. The greatest damage is done to cotton during the period between the appearance of cotyledon leaves

and the beginning of sympodial branching, which, in the case of late sown seedlings, coincides with the appearance of 3rd instar hoppers in May. The presence of attracting weeds, such as *Convolvulus arvensis*, increases infestation, but a watered and broken soil serves as a certain protection. The presence round the field margins of dense thickets of plants that are preferred to cotton sometimes prevents damage to the latter. Irrigated cereals and melons and watermelons are not touched by *C. italicus*, which, however, attacks various vegetables, vines, fruit trees, and particularly lucerne.

A detailed scheme of measures for the complete extermination of *C. italicus* in the oasis is proposed, based on the destruction of ecological conditions favouring its mass appearances. In order to concentrate the pest, the oviposition sites should be destroyed by ploughing and watering the soil in fallow and abandoned lucerne fields, and planting in them dense grasses and perennials or cotton. On field margins, when they cannot be destroyed by the merging of adjoining fields, the ground should be covered by a layer of earth or by dry vegetation, so as to prevent the females from reaching the ground. Some chosen areas suitable for oviposition should be left, and on them the pest would concentrate. The progeny could then be destroyed either in the egg stage, or on hatching in the following spring. The remaining population of *C. italicus*, scattered over waste lands outside the cotton belt, could in its turn be concentrated within small areas and destroyed, such concentration being accomplished by extensive destruction of the thickets of plants that attract different instars, leaving them only in those areas where concentration is desired.

A list of plants damaged by *C. italicus* is appended.

Zimin (L. S.). **On the Biology and Ecology of** *Calliptamus turanicus* **Tarb. in Middle Asia.** [*In Russian.*].—*Acrididae of Central Asia*, pp. 82–112, 4 figs. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

Calliptamus turanicus, Tarb., inhabits the steppes and semi-deserts on the foothills of Turkestan mountains, where it breeds on unploughed lands with a hard compact soil, which occur among the unirrigated cultivated fields, and are overgrown by *Poa*, *Carex*, *Psoralea drupacia* and *Cousinia decurrens*. Observations on its life-history and ecology, which are discussed, were made on the Khatyrchy steppe, Uzbekistan.

The egg and the egg-pods are described and figured, and compared with those of *C. italicus*, L. In 1930 the hoppers of *C. turanicus* hatched throughout May, the adults appeared in early June, and oviposition began in July and continued till September. The behaviour of the hoppers and adults is described and correlated with meteorological factors. The night is passed on plants, and in the morning the hoppers descend to the ground and feed on dry plant remains; with the rise of temperature they re-ascend the plants and feed on green vegetation. In the afternoon, as the temperature decreases, they again descend to the ground and eat dry plants. A table of temperatures at which different instars feed on dry and fresh vegetation respectively is included, and the plants eaten by them are enumerated; from the third instar, *C. turanicus* becomes less selective in food-plants and sometimes attacks *Sorghum* and wheat, while the adults damage cotton and lucerne.

The migrations during the life-cycle are similar to those of *C. italicus*, L. [*cf.* preceding paper], but less pronounced. After hatching, the

hoppers, which in general tend to follow the sun, move to the more open and sunny areas and though the older instars collect among denser vegetation, sometimes invading the oases, the mature adults return to dry open steppes for oviposition.

The enemies of *C. turanicus* include starlings (*Pastor roseus*), lizards, the Solpugid, *Galeodes caspica*, and a number of Sphegid and Asilid predators. The egg-pods are parasitised by *Mylabris frolovi*, Germ.

For control infested ground should be ploughed in deeply in the autumn so that a crust is formed next spring to prevent the hoppers from hatching. The use of moist and dry poisoned baits and the preparation of baits with organic remains, which are readily eaten by *C. turanicus*, are also recommended.

Other injurious Acridids occurring among the non-irrigated cultivations are *Dociostaurus maroccanus*, Thnbg., which is found mostly in the neighbourhood of oases, and *Pyrgodera armata*, F. W., which damages cotton on their margins.

Ivanov (E. N.). **On the Biology and Ecology of** *Oedaleus decorus* **Germ.** [*In Russian.*]—*Acrididae of Central Asia*, pp. 113–123, 1 map, 5 refs. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

Oedaleus decorus, Germ., which has been recorded as damaging cotton in Central Asia, and which in 1928 attacked unirrigated wheat, was studied in 1930 in Dalverzin steppe, Uzbekistan. The distribution and density of the population were estimated by sweeping with a net, and oviposition sites were determined by soil samples.

This species typically inhabits and was very numerous in 1930 in depressions with a humid, sometimes saline soil, overgrown by *Cynodon dactylon* and *Hordeum murinum*. The eggs are laid in the ground overgrown by *Cynodon dactylon*, where the plant cover is of medium density and interspersed with bare patches ; the soil must be a non-saline, humid clay mixed with sand. Hatching takes place in early May, and the adults appear by the middle of June, reach sexual maturation and begin to oviposit in the middle of July, and die off in September. Their behaviour is described and correlated with temperature. In the morning, when the temperature at the surface of the soil reaches 35°C. [95°F.], they migrate to dense thickets of *Cynodon dactylon*, which with *Hordeum*, *Poa* and *Bromus* form the principal food-plants. Feeding occurs mainly in the first half of the day, at air temperatures of 25–36°C. [77–96·8°F.]. In the evening *Oedaleus* returns to the more open areas where the night is passed on the ground. In 1930, 1·38 per cent. of adults were parasitised by the fly, *Blaesoxipha* sp.

Ivanov (E. N.). **The Biology and Ecology of** *Ramburiella turcomana* **F. W.** [*In Russian.*]—*Acrididae of Central Asia*, pp. 124–149. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

Observations on *Ramburiella turcomana*, F. W., which causes considerable damage to unirrigated crops in Central Asia, were made in the Katta-Kurgan region of Uzbekistan, practically the whole of which is under cultivation. Breeding takes place on small areas of unploughed steppe remaining on steep slopes, field margins,

roadsides, and dry depressions, and overgrown by *Poa bulbosa* and *Carex hostii*. The eggs are laid in dry, fairly compact clayey soils, and are most numerous where the vegetation cover is of medium density, but with a dense root-system.

In 1931 hatching began in the middle of April, the adult stage was reached by mid-May, and oviposition commenced in June. The biology and behaviour are described and correlated with temperature ; feeding takes place practically the whole day long, the maximum occurring at 18–26°C. [64·4–78·8°F.] for hoppers and at 24–33°C. [75·2–91·4°F.] for the adults. The food-plants consist of fresh, green graminaceous plants, and only the older instars and the adults occasionally feed on dry vegetation ; the plants attacked by different instars are recorded.

The scattering of the hoppers and their increase in the infested area were studied by means of counting specimens caught in a net laid on the ground and by sweeping. In the second and third instars the hoppers concentrate on unploughed plots overgrown by *Poa* and *Carex* ; when the fourth instar is reached, these plots are drying up and *R. turcomana* begins to migrate towards the still green fallow lands and the cultivations, where 90–95 per cent. are to be found by the end of May and early June, when serious damage is caused to wheat and *Sorghum*. From the middle of June the adults migrate back to unploughed plots for oviposition.

For control the ecological conditions in the breeding centres should be changed by utilising them for cultivation. Where this is impossible, the hoppers, which must be dealt with during the first three instars before they begin to scatter, should be controlled by poison dusting and spraying, as they do not readily take poisoned baits. The egg-deposits must be first registered during the oviposition period, the survey to be supplemented by soil samples taken when egg-laying is complete.

Descriptions are given of the egg-pods and of the five larval instars.

Zakhvatkin (A. A.). **Dipterous Parasites of Acrididae.** [*In Russian.*] —*Acrididae of Central Asia*, pp. 150–207, 10 pls., 1 graph, 5 refs. Tashkent, Central Asiatic Inst. Plant. Prot., 1934. [Recd. July 1936.]

The eggs, first and second instar larvae and pupae of Bombyliid flies, which are the most effective parasites of the eggs of Acridids in Central Asia, are described and illustrated, and keys for determining the adults, larvae and pupae are given. Detailed notes on the bionomics and descriptions are given of the following species: *Callostoma desertorum*, Lw., parasitising the egg-pods of *Dociostaurus* spp., *Calliptamus* spp. and *Ramburiella turcomana*, F. W. ; *Cytherea setosa*, Param., parasitising *Calliptamus* spp. ; *Anthrax oophagus*, Param., sp. n., parasitising *Dociostaurus* spp., *Ramburiella turcomana*, F. W., *Arcyptera* sp. and *Calliptamus turanicus*, Tarb., and sometimes developing as a hyperparasite on the larvae of *Callostoma desertorum* and *Mylabris biguttata*, Gebl. ; *Anthrax jazykovi*, Param., sp. n., suspected of parasitising *Calliptamus italicus*, L., and also attacking the larvae of *Epicauta erythrocephala*, Pall. ; *Anthrax monachus*, Sack., parasitising *Ramburiella turcomana*, F. W., and a hyperparasite of *Mylabris scabiosae*, Ol. ; *Anastoechus nitidulus*, F., parasitising *Calliptamus* spp. ; *Anastoechus*

baigakumensis, Param., parasitising *Locusta migratoria*, L.; and *Exoprosopa* sp., apparently parasitising *Dociostaurus maroccanus*, Thnbg.

IVANOV (E. N.). **The Method of registering Egg-deposits of the Moroccan Locust under Central Asiatic Conditions.** [*In Russian*].—*Acrididae of Central Asia*, pp. 208–219. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

The usual method of registering egg-deposits of *Dociostaurus maroccanus*, Thnbg., and of estimating the infested area by means of soil samples taken after the completion of oviposition in plots equalling a hectare at intervals of 100 metres along parallel lines 100 metres apart is criticised. The area so estimated is always less than that over which control has to be carried out in the next season, and it is better to register the egg-deposits during actual oviposition, estimates then made exceeding the others by 15 to 20 per cent. On reaching sexual maturity at the beginning of June, the adults of *Dociostaurus maroccanus* congregate on unploughed plots with soils of clay or clay and gravel and with a slight cover of *Poa bulbosa* and *Carex hostii*. Here eggs are laid in the forenoon, the ovipositing females collecting on bare patches, so that the distribution of egg-pods is uneven. After 11 a.m., the locusts move to the cultivated fields and depressions covered with dense green vegetation and feed there till about 5 p.m., after which they return to the oviposition site, where the night is passed and mass oviposition is resumed next morning. During the oviposition period, any particular swarm oviposits repeatedly over the same plot, the area of which remains the same, and since it is conspicuous against the ground, the registration and delimitation of egg-deposits should present no difficulties. The surveyed area must be visited every 10 days during the 30–40 days of the oviposition period. The density of oviposition on each egg-deposit must be estimated after the completion of egg-laying, by means of soil samples of $\frac{1}{16}$ sq. m. and 5–7 cm. deep, five to ten samples to be taken on small sites (up to 3 hectares), but only two samples per hectare when the sites are large. The average density of oviposition per square metre should be estimated by dividing the estimated total number of egg-pods on the given plot by the number of samples, and multiplying the result by 16. Specimen forms for records of observations on egg-deposits are included.

IVANOV (E. N.). **A System of Control Measures against the Moroccan Locust in Central Asia.** [*In Russian.*]—*Acrididae of Central Asia*, pp. 220–224. Tashkent, Central Asiatic Inst. Plant. Prot., 1934. [Recd. July 1936.]

A wide-scale anti-hopper campaign should be undertaken throughout the distribution area of *Dociostaurus maroccanus*, Thnbg., in Central Asia, by means of poison baits, which in suitable areas should be scattered from aeroplanes. The locusts that escape and reach the adult stage should be concentrated and destroyed by baits prepared with fresh lucerne and weeds, or dealt with when they concentrate on oviposition sites. The known outbreak centres, situated mostly in unploughed, overgrazed steppes and mountain foothills, should then

be made unsuitable for breeding by being ploughed over and utilised for crops or sown grasses. Permanent observation points should be established for reporting the swarms, particularly near the boundaries, to prevent invasions from the adjoining countries, and also for constant supervision of the known, and location of the yet unknown, breeding centres.

Ivanov (E. N.). **On the Method of registering the Egg-deposits of non-swarming Acrididae among non-irrigated Crops.** [*In Russian.*] —*Acrididae of Central Asia*, pp. 225–228. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

The non-swarming Acridids living among non-irrigated crops in Central Asia, *e.g.*, *Dociostaurus kraussi*, Ing., *Ramburiella turcomana*, F. W., *Calliptamus* spp., etc., cover huge areas, and in 1934 out of 1567 sq. miles infested by egg-deposits, they were responsible for 1108. The egg-deposits should be recorded during the egg-laying period, beginning in the second half of May, and a further survey should be made in September–October to determine, by means of soil samples, the density of the egg-deposits and their specific composition. A specimen form for recording such observations is included.

Lepeshkin (S. N.). **A Preliminary System of Control Measures against *Calliptamus italicus* L.** [*In Russian.*]—*Acrididae of Central Asia*, pp. 229–236. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

Calliptamus italicus, L., is a serious pest of cotton in the oases of Central Asia. The types of habitats chosen for oviposition vary in different areas and are to be found mostly on the margins of the saline fallow lands in the Ferghana valley, field boundaries and waste plots among the cultivated fields in the Zeravshan valley, dry wastelands in the Bokhara oasis, very dry unploughed plots in the Kashka-Dar'ya and Surkhan Dar'ya oases, and old lucerne fields in Turkmenia [*cf. R.A.E.*, A **24** 592].

The autumn survey of the egg-infested areas is effected by first determining by means of soil samples the types of sites liable to be infested, by estimating the total area of such sites in the oasis to determine the potential extent of the infestation, and then by taking further soil samples in selected sites to obtain the actual extent of the infestation. The special characteristics to which attention must be paid in determining the sites liable to be infested in the different habitats are described.

In spring, careful records should be made of the plots on which hatching takes place, and control by poison baits should begin as soon as the second instar is reached in order to prevent the dispersal of the bands and the invasion of the cotton fields. When second instar hoppers are to be poisoned, the area to be dealt with is equal to that over which hatching occurred, increased by 50 per cent. ; for the third instar the increase equals 200–400 per cent., and for older instars and the adults 500 per cent. To facilitate the poisoning of *C. italicus* by baits scattered from an aeroplane, it must be concentrated in definite plots by changing the ecological conditions in most areas suitable for oviposition [*cf.* **24** 593] ; the measures to be adopted for this purpose in different types of habitats are outlined.

Lepeshkin (S. N.). **Registration of** *Calliptamus italicus* **L. in the irrigated Region of Central Asia.** [*In Russian.*]—*Acrididae of Central Asia*, pp. 237–243. Tashkent, Central Asiatic Inst. Plant Prot., 1934. [Recd. July 1936.]

The system is based on a survey of the area occupied by the winged adults and on an estimation of the infested area and of its location by the method described in the previous paper. Detailed instructions for searching for the egg-pods in different oases are given.

[King (K. M.).]. **Insect Pests.**—*Guide to Saskatchewan Agric.*, pp. 42–49. Saskatoon, Sask., May 1936.

This is a popular general account of the chief insect pests of field crops in Saskatchewan and of the methods adopted for their control, which consist mainly of farm practices.

Zeck (E. H.). **The Cherry Aphid** (*Myzus cerasi* **Fab.**).—*Agric. Gaz. N.S.W.* **47** pt. 5 pp. 255–258. Sydney, 1st May 1936.

Myzus cerasi, F., is an introduced species in New South Wales. The wingless viviparous females mature in 9–14 days and produce further young for several generations. They and their progeny survive the winter on the trees, despite severe frosts and snow. Small colonies, their presence usually indicated by the swelling of infested buds, were found throughout the district of infestation, feeding on the dormant trees and producing premature growth. Winged viviparous females become most numerous in November–January, but are scarce during the coldest months. The wingless egg-laying females develop in late autumn and winter, and pair with the winged males. The eggs laid by them also overwinter. Under natural conditions hatching started on 30th July and continued till mid-September.

In an experiment carried out in the insectary in Sydney with 20 young Aphids that hatched on 30th August from overwintering eggs and were placed on the leaves of small cherry trees, 10 generations were produced in 90 days, giving an average period of 9 days from birth to production of young. Wingless parthenogenetic females, hatching from eggs obtained on cherry suckers on 30th August and kept under observation on cherry trees, matured and produced young in 17 days, the first Aphid dying after 35 days and the last after 66 days. Among 5 females 755 young were born, an average of 151 per female, the greatest number of young produced in one day by an individual female being 9. No Aphids were found on the roots of trees or of suckers or in ants' nests near cherry trees.

In control experiments in which nicotine sulphate (1 pt. to 75 gals.) was added to lime-sulphur sprays used for a fungicide in 3 successive applications, the population was reduced to a minimum, though not when it was included only in the first two sprays, applied on 2nd and 29th September.

A watercress (*Lepidium sativum*) occurs as a secondary food-plant in a limited area [*cf. R.A.E.*, A **23** 560], but is unimportant.

Clark (A. F.). **The Needle-tying Moth** (*Tortrix excessana*, **Walk.**).—*N.Z.J. Sci. Tech.* **17** no. 5 pp. 679–685, 4 figs., 4 refs. Wellington, N.Z., April 1936.

Tortrix excessana, Wlk., damages a wide range of trees and shrubs in New Zealand including apples, stone fruits, and introduced conifers.

Brief descriptions of all stages are given. Rearing experiments showed that there are two generations in the year on *Pinus radiata*, but under favourable conditions in the field another partial or complete generation may occur. Larvae collected in the spring pupated in November, and the adults emerged from late November to January. The eggs laid by this generation hatched in late January, and the larvae matured in February ; pupae and first brood adults were recorded in March and April. In late April, the eggs and larvae of the second brood were active, and the latter overwintered. The larvae web the needles together to form a tube, consuming enough of the cuticle to kill them. If disturbed, they migrate fairly freely to other parts of the tree, and form fresh tubes, a single larva thus often doing much damage. In severe infestations practically all the foliage of the tree may be killed. The soft bark of the leading shoot and twigs may also be eaten in patches, causing the tree to exude a resinous material. Infestation is evenly distributed over a given area ; it reaches a climax after two or three seasons and then declines.

Control by spraying is not economically justified, but in nurseries the bunches of discoloured needles containing the larvae should be picked off and destroyed. Fairly effective control is often given by parasites, including *Trichogramma minutum*, Riley [*cf. R.A.E.*, A **20** 379] on the eggs, a Braconid and a Tachinid on the larvae, and a Chalcid on the pupae. The Tachinid occasionally emerged from the pupa also.

Seshagiri Rao (D.). **Sugarcane Borer Control through its natural Enemy in the Irwin Canal Tract.**—*Mysore agric. Cal. 1936* p. 25. Bangalore, 1936.

Mass rearing of the egg-parasite *Trichogramma minutum*, Riley, on *Corcyra cephalonica*, Stn., for release against *Argyria sticticraspis*, Hmps. [*R.A.E.*, A **22** 15 ; **24** 5] has been extended to Mandya. The method employed was the same as that already described [**20** 153]. Approximately 1,071,000 individuals were produced and released over 23 acres of sugar-cane, which improved considerably as a result.

Krishnamurthy (B.). **The Avare Pod-Borers (A new Method of Control).**—*Mysore agric. Cal. 1936* pp. 25, 29 & 33. Bangalore, 1936.

This paper deals collectively with *Adisura atkinsoni*, Moore, *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.), *Maruca testulalis*, Geyer, *Sphenarches caffer*, Zell., and *Exelastis atomosa*, Wlsm., all of which do serious damage to avare [*Dolichos*] in Mysore. The females of all these moths lay their eggs singly on the pods, flowers and buds, beginning in late October. The larvae feed on the pods and later bore into them and feed vigorously on the seeds, developing rapidly. When full-fed the majority pupate about 2 inches below the surface of the soil but some on the flower spikes. The borers are most active from mid-December to late January. Larvae of the last generation pupate in the soil, where they remain until the following October.

A solution of bleaching powder (1 lb. powder to 8 gals. water) uniformly applied with a hand-syringe to newly-opened flowers and young pods as early as possible in the season, and repeated 2–3 times at fortnightly intervals on flowers and pods developing later, costs little and effectively repels the adults until the pods have become too

old to be attractive for egg laying. By harvest time, the colour is again normal. Infestation increased much more slowly throughout the season on treated than on untreated plots, rising from a uniform 5 per cent. to 33 and 88 per cent. respectively. The weight of the crop and net profit were increased by nearly 75 per cent.

HOWARD (Sir A.). **The Role of Insects and Fungi in Agriculture.**—*Emp. Cott. Gr. Rev.* **13** no. 3 pp. 186–192. London, July 1936.

The author believes, from long experience in India, that insects and fungi only attack varieties of plants unsuited to their environment, or badly cultivated crops. In tests at Pusa to find varieties of cotton suitable for local conditions, only the local North Bihar variety withstood the attack of insect pests that infested other Indian and American varieties. Pests are therefore useful to indicate the unsuitability of the crop to the district, and the effectiveness of the type of cultivation ; regulations to prevent the import of insect pests are harmful in that they restrict the supply of indicators. At Indore, methods of cultivation (including surface drainage and dressings of fermented organic matter) produce cotton practically immune from the local insects and fungi. Infestation of fruit trees by Aphids at Quetta seems to depend on the aeration of the soil, and can be produced on peaches and almonds by over-irrigation in the winter and spring, and ended by deep cultivation, so that the Aphids do not spread from the lower portions of twigs to the new shoots or leaves. Deep-rooted varieties of *Lathyrus sativus* at Pusa were always attacked, but the shallow-rooted types, which under the local soil conditions could alone obtain enough air for their roots, were immune. Aphids were never observed to move from the former to the latter.

VAN EMDEN (F.). **Schädlinge des Weinstocks, der Beerensträucher und der Erdbeere.** [Pests of the Grape Vine, Berry Bushes and Strawberry.]—63 pp., 26 figs., 1 col. pl. Leipzig, Hachmeister & Thal, 1936. Price *M.* 0·70.

This is a fourth, revised edition of a booklet for German growers. The pests, which are almost exclusively insects, are divided according to the part attacked, with particulars of their life-history and control.

Insects.—*Bull. Wisconsin agric. Exp. Sta.* no. 435 (Ann. Rep. 1934–35), pp. 116–127, 4 figs. Madison, Wis., March 1936. [Recd. June 1936.]

No successful control has yet been found for the apple curculio [*Tachypterellus quadrigibbus magnus*, List], which is injurious in south-western Wisconsin [*R.A.E.*, A **24** 65]. As adults found on wild species of *Crataegus* are usually considerably smaller than those on apple, it is thought that the weevils rarely pass from one to the other and that to destroy the wild food-plants would increase the infestation on apples. Poison sprays failed to give satisfactory control, with the exception of lead arsenate, which, however, was only effective if applied in quantities that left an excessive amount of residue on the fruit.

The experiments on the use of certain silicates of soda to reduce lead arsenate spray residues [**24** 64] were continued by C. L. Fluke, E. P. Dunn, P. O. Ritcher and J. H. Lilly, and it was concluded that, added

to the last cover spray, they definitely aided the natural weathering of the residues. A highly alkaline silicate appeared to be necessary. The addition of sodium silicate to the last cover spray increased the effectiveness of a rinsing spray of water at picking time. The water rinse was most effective after the sodium silicate had dried.

Continuing control experiments against the cherry case-bearer [*Coleophora pruniella*, Clem.] on apple [**23** 174; **24** 65], Lilly found that various commercial preparations added to lime-sulphur or a 4 per cent. oil emulsion increased their effect against this Tineid and the bud moth [*Eucosma ocellana*, Schiff.] and leaf roller [*Tortrix argyrospila*, Wlk.] The most effective materials included a selenium compound (Selocide) with both sprays [**24** 546] and nicotine sulphate with the lime-sulphur. Lime-sulphur alone, at 1 : 12, again gave commercial control. A trial with 17 proprietary oil spray preparations, all used at 6 per cent., confirmed previous findings that those containing tar oils give slightly better control than those consisting entirely of petroleum oils, tar oil being more effective against the bud moth and petroleum against leaf rollers. Tests to find a better combination spray are being continued.

Lead arsenate for the control of June beetles [*Lachnosterna*] on oak trees [**24** 64] was found to act as a repellent and not as a killing agent. In field cage experiments, the beetles fed very slightly on oak foliage sprayed with lead arsenate, zinc arsenate and coated lead arsenates, but stripped untreated foliage and almost stripped foliage treated with manganese arsenate. Three coated lead arsenates appeared to be more toxic to them than lead arsenate, zinc arsenate or manganese arsenate.

H. F. Wilson and C. E. Holmes investigated the danger of poisoning to fowls by the Wisconsin grasshopper bait (1 bushel sawdust, 1 U.S. gal. whey, 1 lb. arsenic). Fowls refused to eat appreciable quantities, even when no other food was available. They ate very little of a mixture in which 50 per cent. bran and 50 per cent. sawdust were used, trying to pick out the bran, and none showed any sign of poisoning. When a bran mash containing 4 per cent. arsenic was given to 24 fowls, 2 died, 1 having consumed 3 gm. arsenic and the other 1 gm. The remaining 22 gradually gave up eating and survived, although some consumed as much as 2 gm. arsenic in 3 days. All the fowls fed on arsenic stopped laying within a few days. Edible parts of fowls fed for 3 months on mash containing arsenic were analysed. The largest concentration of arsenic found was 2·08 mg. in 401 gm. meat, a fatal dose for a man being 130 mg. Eggs from the fowls were analysed and found not to contain dangerous quantities of arsenic. After analysis the eggs and 12 of the fowls were eaten without producing any ill effect.

J. E. Dudley and T. E. Bronson in co-operation with the Wisconsin Station carried out experiments with various sprays and dusts against the pea aphis [*Macrosiphum onobrychis*, Boy.] on canning peas. Pyrethrum sprays were ineffective. Strong nicotine sprays and dusts killed nearly all the Aphids when the temperature was high and there was no wind. When derris sprays (rotenone 3·7 per cent.) were used, the Aphids died over a period of 3–5 days, reproducing little during this time, and the plants remained uninfested for a longer period than after any other poison. Derris dust was not so consistently satisfactory. Yields of peas showed increases of 68–131 per cent. in treated plots, the average increase being 86 per cent. One application of derris (3 lb. to 100 U.S. gals. water) on late planted peas in the autumn, after the infestation had begun, killed 95 per cent. of the Aphids and protected

the peas for nearly a month. Sprays containing $\frac{1}{4}$ or $\frac{1}{2}$ lb. derris per 100 U.S. gals. water with wetting agents killed nearly as large a percentage.

In continued tests by T. C. Allen [*cf.* **23** 475], an atomised spray of a highly refined kerosene cut petroleum oil containing 3 per cent. pyrethrum extract gave a good control of the potato leafhopper [*Empoasca fabae*, Harr.]. Different varieties of squash were found to differ in susceptibility to *Melittia satyriniformis*, Hb.

PLANK (H. K.). **Results of Miscellaneous Insecticides used on Larvae of the Peach Twig Borer in Hibernation.**—*Bull. Dep. Agric. Calif.* **25** no. 2 pp. 216–225. Sacramento, Calif., 1936.

During the winter of 1932–33, experiments were made with oils and other spray materials, with and without the addition of toxic compounds, against the larvae of *Anarsia lineatella*, Zell., in their hibernaculae. Between 9th December and 1st March, 34 different treatments were applied to one-year-old water-sprouts growing on peach stumps in two abandoned orchards in northern California. Parasitisation of *A. lineatella* averaged 49·6 per cent. with a maximum of 67 per cent. in one of the orchards, but only 14·2 per cent. in the other, *Euderus* (*Secodella*) *cushmani*, Cwfd., being mainly responsible [*cf. R.A.E.*, A **22** 157]. The only predator suspected of attacking the larvae was *Leptothrips mali*, Fitch, which was not observed to do so, but was found in empty hibernaculae. Of the unemulsified oils tested, a white mineral oil of about 52 seconds viscosity and 95 per cent. unsulphonated residue gave about 88 per cent. control and caused a minimum of injury to the parasites and to the tree, proving superior to a lighter oil blend and its combinations with toxic compounds. Heavy oils, emulsified or otherwise treated to make them emulsive or miscible in water, gave very poor control and injured the twigs at the strengths used. Pine tar oils and beta-naphthol gave uniformly poor control. Commercial liquid lime-sulphur at the strength generally used to combat the borer during the early blossoming stage of the peach (7–10 gals. to 100 gals. water) gave control decidedly inferior to a number of the oil treatments. The addition of fumigants did not seem to increase the toxicity of the sprays, but pyrethrum added to one oil and an oil emulsion seemed to effect a marked improvement in the control, without killing the parasites.

KEIFER (H. H.). **California Microlepidoptera IX.**—*Bull. Dep. Agric. Calif.* **25** no. 2 pp. 235–259, 7 pls. Sacramento, Calif., 1936.

Owing to injury caused to tomato in the western United States by *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, the economic importance of certain small moths of this genus attacking solanaceous plants has recently been increased. It is possible that injury to tomato attributed to *P. lycopersicella* is sometimes due to *P.* (*G.*) *operculella*, Zell., or to *Heliothis armigera*, Hb. (*obsoleta*, F.). A comparison is therefore made of the characters distinguishing a small larva of *H. armigera* and a mature larva of *P. lycopersicella*. Nine Californian species of *Phthorimaea* and allied genera, of which 5 are new and one belongs to a new genus, are described and their systematic position is discussed.

LANGE, jr. (W. H.). **The Biology of the Orange Tortrix,** *Eulia* (*Argyrotaenia*) *citrana* **Fern.**—*Bull. Dep. Agric. Calif.* **25** no. 2 pp. 283–285, 1 fig., 4 refs. Sacramento, Calif., 1936.

Larvae of *Eulia citrana*, Fern., which is a native pest on a variety of plants throughout the coastal districts of California, were found during the summers of 1933–34 webbing and destroying the needles of several young potted Monterey pines (*Pinus radiata*) at Berkeley. This appears to be the first record from a coniferous food-plant. Data on the life-history, with descriptions of all stages, are given, obtained from 15 adults reared through the complete life-cycle in the laboratory, and from partial records and observations on *P. radiata* under natural conditions. Individual females isolated after pairing laid 85–245 eggs each. The incubation period varies with the temperature ; it was 8–15 days in the laboratory and 29–44 days under natural conditions. The newly hatched larvae are very active, disperse quickly and begin feeding near the base of the bundles or under a bud bract where the protective web is spun. They start by eating out the interior of the needles at the base under the sheath, but their feeding becomes more and more external as they develop until they finally abandon mining. Pupation occurs in a thin silk cocoon in a protected spot between the needles, along the twigs, or on the main stem. There are at least two generations a year on *P. radiata*. The larvae hibernate in all stages, and mature larvae pupate quickly in spring, the adults emerging and ovipositing to form the spring generation. Although *E. citrana* has not damaged enough young pines to be of much importance, the feeding on terminal and lateral shoots causes severe set-back to individual trees.

POOS (F. W.) & ELLIOTT (C.). **Certain Insect Vectors of** *Aplanobacter stewarti*.—*J. agric. Res.* **52** no. 8 pp. 585–608, 13 figs., 7 refs. Washington, D.C., May 1936.

Experiments confirmed the findings of previous investigators that it is highly improbable that *Aplanobacter stewarti*, which causes bacterial wilt of maize, is transmitted through the soil [*cf. R.A.E.*, A **12** 120]. During 1934, following two years in which attacks were particularly severe, special attention was paid to the question of insect dissemination. In tests under controlled conditions in Virginia, adults of *Chaetocnema pulicaria*, Melsh., *C. denticulata*, Ill., and *Diabrotica duodecimpunctata*, F., transmitted the disease [**23** 167], with facility in the order named, while the larvae of these insects and adults of 13 others failed to do so. The bacterium was found to overwinter in *C. pulicaria* [**22** 600]. To determine the species that contained it under field conditions, 7,338 individuals (representing 40 different species) were taken in various localities in the United States on or near infected maize and disinfected externally, and each individual was crushed separately in sterile beef peptone broth. From the plates obtained, 3,977 isolations were made, of which 1,464 were tested by inoculation on maize, 953 yielding positive results. Of these 916 were from *C. pulicaria*, transfers from these colonies producing wilt symptoms. *C. denticulata* yielded 30 isolations of *A. stewarti* and specimens thought to be *C. confinis*, Crotch, 2, but it is probable that the latter were in reality *C. pulicaria*, as the two species are closely allied and, contrary

to evidence in 1905, *C. confinis* was found to cause no injury and to die prematurely when confined to maize. Of other genera, 5 species, of which only a few individuals were available, each yielded 1 isolation of the organism. In the autumn, *A. stewarti* was isolated from *C. pulicaria* but not from *C. denticulata* or *D. duodecimpunctata*. On an average 55·6 per cent. of adults of *C. pulicaria* and 47·8 per cent. of *C. denticulata* were found to contain *A. stewarti* after being confined on infected maize for 5 days or more. In addition to maize, *Euchlaena mexicana* (teosinte) was found to be a natural host of *A. stewarti*, and also contracted the wilt when *C. pulicaria* was transferred to it from diseased maize. *Coix* sp. contracted the disease both from the beetle and from the needle inoculations. The vector responsible for the occurrence of the disease in California is probably *C. ectypa*, Horn.

C. pulicaria hibernates in the adult stage, becomes active when the temperature reaches 70°F. at the surface of the soil, and attacks the young maize as soon as the shoots appear above ground. Feeding in the open is usually on the upper surface of the leaves. The immature forms, which have not been identified in nature, probably develop in the soil. This Halticid, which has been reported from most of the United States except the north-west, feeds on a large variety of plants. *C. denticulata* passed through two complete generations on *Sorghum* in 1934, but under controlled conditions the life-cycle occupied only about a month. The eggs are laid at the base of the food-plant, and the larvae feed on the young leaves and seed heads and pupate in the soil. The winter is passed in the adult stage. Experiments showed that *C. pulicaria* and *C. denticulata* apparently remain infective for approximately their entire life, some transmitting the bacteria 49 days after being removed from sources of infection. Adults of *D. duodecimpunctata* were able to transmit the organism 5–9 days after being removed from diseased plants.

N. E. Stevens reported in 1934 that no obvious relation existed between severity of bacterial wilt and rainfall, or temperature in spring, summer and autumn, but that the disease was proportionate to the winter temperature, being absent when the sum of the mean temperatures of December, January and February was below 90°F. and present in destructive amounts when it was above 100°F. In 1934, following a severe winter, *C. pulicaria* was scarce in the north-eastern States, but where it was abundant, *A. stewarti* was isolated from it. The relation of winter temperatures to the abundance and distribution of the insects that overwinter and disseminate *A. stewarti* may be significant in predicting the prevalence of the wilt.

FREAR (D. E. H.) & HODGKISS (W. S.). **Accuracy of the Determination of Lead and Arsenic on Apples.**—*J. agric. Res.* **52** no. 8 pp. 639–644, 8 refs. Washington, D.C., May 1936.

The errors involved in the determination of lead and arsenic as spray residues on apples are discussed with reference to the analysis of 164 samples in duplicate. It is concluded that the determination of lead (by the photoelectric cell method) was slightly more accurate than that of arsenic (by the Gutzeit method), since the average deviation of individual lead determinations from the mean of the duplicate determinations was 6·8 per cent. of the mean, while for arsenic it was 7·4 per cent. of the mean.

Marston (A. R.). **Michigan Hybrid No. 561 a Borer-resistant Field Corn.**—*Quart. Bull. Mich. agric. Exp. Sta.* **18** no. 4 pp. 223–225, 2 figs. East Lansing, Mich., May 1936.

Breeding experiments carried on in Michigan since 1926 have resulted in the production of a variety of maize (Hybrid No. 561) resistant to the attack of the European corn borer [*Pyrausta nubilalis*, Hb.], and suitable for the southern part of Michigan. In tests in 1935, it gave about 10 bushels more maize to the acre than the recommended commercial variety, and in one field about 20 borers were found in 100 plants of the hybrid compared with 80 borers to 100 plants of the commercial variety.

Knowlton (G. F.) & Smith (C. F.). *Capitophorus* **Aphids infesting** *Chrysothamnus*.—*Canad. Ent.* **68** no. 5 pp. 107–113, 2 figs. Orillia, May 1936.

A review is given of the 12 species of Aphids of the genus *Capitophorus* that occur on *Chrysothamnus* in the west and middle-west of the United States, six of which are described as new. Some species of *Chrysothamnus* are of value as forage.

Stirrett (G. M.). **Notes on the "Flat Wireworm,"** *Aeolus mellillus* **Say.**—*Canad. Ent.* **68** no. 5 pp. 117–118. Orillia, May 1936.

Notes are given on the appearance of the adult and larva of *Aeolus mellillus*, Say,* which is doing increasing damage to tobacco and to a less degree maize and sugar-beet in southern Ontario, where it was first found to be injurious in 1930. It has been recorded elsewhere in Canada, but not as a pest, and no male has been taken in the Dominion, or nearer than Kansas (according to W.J. Brown). Since no female has laid eggs in captivity, it remains doubtful whether reproduction is parthenogenetic. *A. mellillus* requires one year to complete its life-cycle, although most of the other common wireworms of the district require two or three. Severe injury is done during the first year to crops planted on newly ploughed sod land, but damage also occurs to crops on land longer under cultivation. A search is being made for some repellent or poison that could be applied with the water when the tobacco plants are set out in the field.

Balch (R. E.). **The Balsam Woolly Aphid.**—*Spec. Circ. Div. For. Ins. Dep. Agric. Canada* [no. 10] 3 pp., 1 pl. Ottawa, March 1936. [Recd. July 1936.]

Chermes (*Adelges*) *piceae*, Ratz., has been causing serious injury to firs (*Abies*) throughout Nova Scotia for the last 10 years, and is spreading westward. All stages and the bionomics [*R.A.E.*, A **21** 283; **22** 313, 396, etc.] are briefly described. Adults and eggs are killed by the winter temperatures, and larvae above the snow by a temperature below −30°F.

Apart from causing damage by feeding on the twigs, the Aphids may heavily attack the stem, covering it with their wool-like secretion, and often killing the tree within a year. Trees thus attacked should be cut during the winter, and if not utilised, carefully peeled or burned over

* [We are unable to trace this; possibly the insect concerned is that generally known as *Drasterius dorsalis*, Say.—Ed.]

with a torch. After a severe winter, the larvae are found only on the base of the trunk, and spraying of infested parts in late winter or early spring with oil emulsion will destroy them without injuring the trees. This is the best way of saving ornamental trees.

Tucker (R. W. E.). **Parasites Introduced into Barbados for Control of Insect Pests.**—*Agric. J. Barbados* **5** no. 1 reprint 22 pp., 8 refs. Barbados, January 1936.

A review is given of the work carried out in Barbados since 1927 on the control of native pests by the introduction of parasites and predators, including *Ipobracon grenadensis*, Ashm., *Microdus stigmaterus*, Cress. (*diatraeae*, Turner), *Lixophaga diatraeae*, Tns., *Trichogramma minutum*, Riley, and *Paratheresia claripalpis*, Wulp, against *Diatraea saccharalis*, F., on sugar-cane [*cf. R.A.E.*, A **17** 309, 356 ; **23** 712, etc.] ; *Ufens osborni*, Dozier, which was imported unsuccessfully in 1931, but has since been shown to be largely a secondary parasite [*cf.* **22** 539], and *Tetrastichus haitiensis*, Gah. [*cf.* **22** 699, etc.] against *Diaprepes abbreviatus*, L., on the roots of sugar-cane ; *Elis ephippium*, Rohw., *E. haemorrhoidalis*, F., *Campsomeris trifasciata*, F., *C. tricincta*, F., and *Pyrophorus luminosus*, Ill., against *Lachnosterna smithi*, Arrow, on sugar-cane [*cf.* **22** 699 ; **23** 713] ; *Microbracon kirkpatricki*, Wlkn., against *Platyedra* (*Pectinophora*) *gossypiella*, Saund., on cotton [*cf.* **18** 468] ; and *Compsilura concinnata*, Mg. [*cf.* **19** 720], against Lepidopterous defoliators of cotton and sweet potato. No positive results have been obtained from most of these introductions.

Entomological Section.—*Rep. Dep. Agric. Kenya 1934* **2** pp. 17–23. Nairobi, 1936.

A brief review is given of work done in Kenya during 1934, mainly on insect pests of coffee. Much of the information has already been noticed [*R.A.E.*, A **23** 143 ; **24** 111, 219]. The fall of coffee berries during June was found to be caused by *Ceratitis capitata*, Wied., which normally oviposits only in the ripe fruits. As only 5 larvae were recovered from a large collection of the fallen fruits, it is concluded that unfavourable climatic conditions produced a state of the berry that induced oviposition, but did not permit the full development of the resultant larvae.

Cheo (Ming-Tsang). **A preliminary List of the Insects and Arachnids injurious to economic Plants in China.**—*Peking nat. Hist. Bull.* **10** pt. 4 pp. 291–308. Peiping, June 1936.

This list, which is a continuation of previous ones [*R.A.E.*, A **24** 324, etc.], comprises 151 Lepidoptera, and shows the plants they attack and their distribution in China.

Boese (G.). **Der Einfluss tierischer Parasiten auf den Organismus der Insekten.** [On the Influence of Animal Parasites on the Insect Organism.]—*Z. Parasitenk.* **8** no. 3 pp. 243–284, 40 figs., 47 refs. Berlin, 4th March 1936.

This paper is an investigation of the effects of parasites of insects on the tissues of their hosts, and the reactions of the host tissue to parasitism. Sections deal with the reactions of the blood and of the

oenocytes, the effect of parasitism on the fat-body and other tissues, and the adaptation of parasites to hosts, as exemplified by *Apanteles glomeratus*, L., which shows a much higher percentage of survival in larvae of *Pieris brassicae*, L., than in other hosts.

[Rekach (V. N.) & Dobretzova (T. A.).] **Рекач (В. Н.) и Добрецова (Т. А.). A Survey of Insects injurious to Utility and Forage Crops in Transcaucasia.** [*In Russian.*]—*Trud. zakavksk. nauch.-issled. khlopk. Inst.* no. 45, 236 pp., 116 figs., 19 graphs, 61 refs. Tiflis, 1935. Price 7 *rub.* 50 *kop.* (With a Summary in English.) [Recd. July 1936.]

Notes, largely based on observations of the authors during 1925–33, are given on the cycle of development, food-plants and economic importance of numerous pests that infest cultivated plants in Transcaucasia. They are dealt with systematically under their orders, and comprise about 340 species attacking 35 different crops belonging to 10 families. Special attention is devoted to 156 pests of cotton [*cf. R.A.E.*, A **22** 486, etc.] and to insects infesting lucerne and peas, which are the chief fodder crops in Transcaucasia. A systematic list of the pests is appended showing their local distribution, the crops attacked and the degree of their economic importance. In another list the pests are shown under the crops they infest, and in a third insects occurring in Transcaucasia that might become pests are recorded.

Papers noticed by Title only.

Kirkpatrick (T. W.). **The Ecology of Coffee Plantations. Climatic Conditions in East African Coffee Plantations.**—*E. Afr. agric. J.* **1** no. 6 pp. 476–486, 1 graph. Nairobi, May 1936. [Summary of paper already noticed: *R.A.E.*, A **23** 422.]

Porter (C. E.). **El piojo de las abejas** (*Braula coeca* **Nitzsch, 1818).** [The Bee-louse, *B. coeca* (a summary from the literature).]—*Rev. chil. Hist. nat.* **39** (1935) pp. 141–144, 1 fig., 7 refs. Santiago, Chile, 1936. [*Cf. R.A.E.*, A **20** 121, etc.]

da Costa Lima (A.). **Terceiro catalogo dos insectos que vivem nas plantas do Brasil.** [Third (revised and enlarged) List of the Insects living on Plants in Brazil (as recorded up to 31st May 1935, with a bibliography of Brazilian entomological literature).]—460+iv pp. Rio de Janeiro, Minist. Agric. Escola Agron. May 1936. [*Cf. R.A.E.*, A **19** 311, etc.]

d'Araujo e Silva (A. G.). **Alguns insectos com os seus respectivos hospedeiros.** [A list of 145 species of insects from Brazil with their food-plants.]—39 pp. Rio de Janeiro, May 1936.

Wille (J.). **Informe sobre un viaje de estudios ejecutado por el entomologo . . . a las zonas de Chanchamayo y Huanuco, del 9 al 20 de Setiembre de 1935.** [Report on a Journey by the Entomologist to Chanchamayo and Huanuco (Peru) in September 1935, including records of miscellaneous pests.]—*Bol. Direcc. Agric. Ganad. Peru* **5** no. 19 pp. 41–54, 11 figs. Lima, 1935. [Recd. June 1936.] [See *R.A.E.*, A **24** 330.]

Smith (R. C.) & Kelly [E. G.]. **The Fourth Annual Summary of the more important Insects of Kansas covering the year 1934.**—*Trans. Kansas Acad. Sci.* **38** pp. 171–185, 2 refs. Manhattan, Kans., 1935. [Recd. May 1936.] [*Cf. R.A.E.*, A **22** 301.]

Knowlton (G. F.) & Smith (C. F.). **The Aphid Genus *Epameibaphis* in Utah** [including *E. utahensis*, sp. n.].—*Proc. ent. Soc. Wash.* **38** no. 5 pp. 89–92, 1 fig. Washington, D.C., May 1936.

Balachowsky (A.). **Note sur *Aspidiotus* (*Hemiberlesea*) *vuilleti* Marchal (Hem. Coccidae).**—*Bull. Soc. ent. Fr.* **41** no. 7 pp. 97–100, 3 figs., 3 refs. Paris, 1936.

Balachowsky (A.). **Contribution à l'étude des Coccides de France. (22me note). Sur une Lecanine nouvelle** [*Ctenochiton ericae*, sp. n.] **du Massif de l'Esterel.**]—*Bull. Soc. ent. Fr.* **41** no. 8 pp. 122–125, 8 figs., 7 refs. Paris, 1936.

Kéler (S.). **A Catalogue of the Polish Thysanoptera.** [*In Polish.*]—*Prace Wydz. Chor. Rośl. państw. Inst. Nauk Gosp. wiejsk. Bydgoszczy* no. 15 pp. 81–149, 5 pls., 4 pp. refs. Bydgoszcz, 1936. (With a Summary in English.)

Kéler (S.). **Some Remarks concerning the Genus *Thrips* Linné.**—*Prace Wydz. Chor. Rośl. państw. Inst. Nauk Gosp. wiejsk. Bydgoszczy* no. 15 pp. 151–154. Bydgoszcz, 1936. [*Cf. R.A.E.*, A **22** 232.]

Britton (E. B.). **A Record of the Parasitic Mite—*Pediculoides ventricosus* (Newp.) in Monmouthshire** [on larvae of *Scolytus scolytus*, F. (*destructor*, Ol.)].—*Trans. Cardiff Nat. Soc.* **67** (1934) pp. 109–110, 2 refs., 4 figs. Cardiff, 1936.

Mani (M. S.). **A new Encyrtid Chalcid Genus, *Krishnieriella*, from India** [erected for *K. ceroplastodis*, sp. n., a parasite of *Ceroplastodes cajani*, Mask.]—*Rec. Indian Mus.* **37** pt. 4 pp. 421–423, 2 figs. Calcutta, December 1935. [Recd. June 1936.]

Nakayama (S.). **The more important Insects injurious to Agriculture in Korea. Third edition.** [Giving brief descriptions and the bionomics of 111 insects, with methods for their control.]. [*In Japanese.*]—Crown 8vo, [5] 236 [13] pp., 107 figs. Keijo, Chosen Nokai, 1936.

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Fernández (O.) & Del Castillo (M.). **Determinación de los principios activos en los polvos insecticidas de pelitre.** [The Determination of the active Principles in Pyrethrum Insecticide Dusts.] —*Primer Congr. nac. Sanidad* (1934), *Actas* **4** pp. 60–64. Madrid, 1935. [Recd. July 1936.]

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BOLETIN DE LA DIRECCION DE ESTUDIOS BIOLOGICAS (MEXICO) :
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